The National Mission on Biodiesel:

A study of science, development and policy processes in India

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ABSTRACT

Biofuel has caught the imagination of countries worldwide as a tool for providing energy security, advancing rural development, promoting environmental sustainability, mitigating climate change, and enhancing international trade. Developing countries in particular are said to have much to gain from biofuel. Testimony to the belief in its ability to deliver a multitude of societal benefits, a number of developing countries have initiated large-scale biofuel projects. Among them is the Indian National Mission on Biodiesel.

However, the global tide of enthusiasm behind biofuel is turning. Biofuel has been named as a culprit in recent and rapid increases in the price of staple foods. Its environmental credentials have also come under scrutiny, and there are claims that biofuel will exacerbate, as opposed to mitigate, climate change. The impacts of international trade in biofuel are also said to be ambiguous. Existing trade regimes are unable to provide clear guidelines as to how biofuel trade should be governed. There are suggestions that under current circumstances, biofuel-exporting developing countries – and small-scale producers in particular – are likely to be disadvantaged

This MPhil thesis is a study of science, policy and development processes around the National Mission on Biodiesel in India. Empirically, it adds a qualitative account to an emerging, and largely quantitative, knowledge base on biofuel. Theoretically, it contributes to the growing convergence of social science disciplines. Science and

Technology Studies (STS), itself an interdisciplinary field of scholarship, provides the starting point for the research. It also draws upon concepts from other subjects – notably those from Development Studies that explore environmental and natural resource issues – to augment the analysis. In the process, the thesis provides inputs for the further evolution of theoretical concepts that span multiple academic traditions.

The aims of the thesis are threefold. Firstly, it seeks to understand and critically comment upon the vision of technology and its relationship to society that underpins biofuel in general, and the National Mission on Biodiesel in particular. Secondly, the thesis attempts to identify the narratives that are dominant in the National Mission on Biodiesel, and to explore the processes through which they have become stabilised given the contention around biofuel. The National Mission on Biodiesel intends to rely on a complex network of local governance institutions that exists in the Indian countryside to deliver its rural development benefits. The final aim of the thesis is to cast the ambitions of the National Mission on Biodiesel against past experiences of implementing development projects through these institutions. This is in efforts to make tentative statements about the likelihood of the Mission achieving its goals.

The research reveals a seemingly unquestioning conviction in the ability of biofuel to transform societies towards pre-defined ends – even in the face of claims to the contrary. Although such 'technological determinism' has been largely discredited by Science and Technology Studies, the paradigm shows remarkable staying power. With its tradition of 'development through modernisation', the Indian policy context has been particularly conducive to expert-led, technocratic interventions. One of the rationales for establishing local governance institutions was to erode this elite-dominance of development initiatives. Despite their intentions, however, such

institutions have proved less than effective in enrolling a wider range of stakeholders – particularly marginalised communities – into development processes. Set against this backdrop, the 'pro-poor' outcomes of the National Mission on Biodiesel appear elusive.

DECLARATION

I hereby declare that I am the author of this thesis. The work is entirely my own unless otherwise stated. The work has not been submitted for any other degree or professional qualification except as specified.

Maija Hirvonen

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CONTENTS

LIST OF ABBREVIATIONS

ANT	Actor-Network Theory
ARAI	Automotive Research Association of India
BIS	Bureau of Indian Standards
BJP	Bharatiya Janata Party
CAPART	Council for the Advancement of People's Action and Rural Technology
CDM	Clean Development Mechanism
CPCB	Central Pollution Control Board
CSIR	Council of Scientific and Industrial Research
DAC	Department of Agriculture and Cooperation
DBT	Department of Biotechnology
DLR	Department of Land Resources
EBP	Ethanol Blending Programme
EPA	Environmental Protection Agency
EU	European Union
FAO	Food and Agriculture Organisation
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GMO	Genetically Modified Organism
GTZ	German Technical Cooperation Agency
ICAR	Indian Council of Agricultural Research
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IEA	International Energy Agency
IICT	Indian Institute of Chemical Toxicology
IIP	Indian Institute of Petroleum
IIT	Indian Institute of Technology
IOC (R&D)	Indian Oil Corporation (Research and Development)
IREDA	Indian Renewable Energy Development Agency
IWDP	Integrated Watershed Development Programme
KVIC	Khadi and Village Industries Commission
LSTS	Large Socio-Technical Systems
MNES	Ministry of Non-Conventional Energy Sources
MOA	Ministry of Agriculture

MOEF	Ministry of Environment and Forests
MOF	Ministry of Finance
MoI&B	Ministry of Information and Broadcasting
MOP & NG	Ministry of Petroleum and Natural Gas
MORT (NHAI)	Ministry of Road Transport and Highways (National Highways Authority of India)
MoSS & VI	Ministry of Small Scale Industries and Village Industries
MPLADS	Member of Parliament Local Area Development Scheme
MRD	Ministry for Rural Development
NGO	Non-governmental Organisation
NMB	National Mission on Biodiesel
NOVOD	National Oilseeds and Vegetable Oil Development Board
PCRA	Petroleum Conservation Research Association
PIM	Participatory Irrigation Management
RTFO	Renewable Transport Fuel Obligation
SCOT	Social Construction of Technology
SGRY	Swarnajayanti Gram Rozgar Yojna
SGSY	Swarnajayanti Gram Swarozgar Yojna
SIAM	Society for Indian Automobile Manufacturers
STS	Science and Technology Studies
TDP	Telugu Dessam Party (TDP)
TRIFED	Tribal Cooperative Marketing Development Federation of India
UNEP	United Nations Environment Programme
WTO	World Trade Organisation
WUA	Water User Association

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CHAPTER 1: INTRODUCTION

1.1. INTRODUCTION: THE CHANGING FORTUNES OF BIOFUEL

According to the 2006 World Energy Outlook (IEA 2006), the global community is faced with "two visions of the energy future: under-invested, vulnerable and dirty, and clean, clever and competitive" (p. 1). Reflecting this paradigm, the past few years have witnessed a proliferation of targets – such as the United Kingdom's Renewable Transport Fuel Obligations (RTFOs) – that attempt to stimulate the replacement of fossil fuels with their more sustainable counterparts. Among the renewable energy options that are being considered, biofuels (fuels derived from organic matter) appear to be receiving considerable attention as a means of combating climate change, decreasing dependence on costly and uncertain oil resources, regenerating rural areas and stimulating international trade. The European Union (EU) is committed to replacing 10% of its overall transport fuel supply with biofuel by 2020 (European Union 2007). Similarly, the Environmental Protection Agency (EPA) of the United States has set a renewable fuel target of 7.76% for 2008 (EPA website).[1] A number of developing countries have followed suit, devising their own national biofuel strategies.

India is among the countries that are actively supporting the emergence of national biofuel production capacity. Its economy is growing at a rapid rate;[2] however, this economic expansion is bringing in its wake concerns over energy security,

[1] EPA website. http://www.epa.gov/OMS/renewablefuels/ (Accessed 27.5.2008)
[2] According to the World Bank (2008a), India's economy grew at a rate of 8.4% in 2008.

environmental sustainability and widening income disparities. Touted as an environmentally benign method of producing energy domestically and, in the process generating rural employment, biofuel has captured the imagination of Indian policy-makers. The Planning Commission of India has devised a National Mission on Biodiesel (Planning Commission of India 2003) to capitalise on the perceived potential of biofuel. This scheme relies on *Jatropha curcas* as the feedstock of choice. The seeds of the plant yield non-edible oil, and as a consequence, *Jatropha* is thought to minimise competition with food production. The crop is also said to thrive in arid areas, making it ideal for what are seen as unused 'wastelands' throughout India.

However, initiatives such as India's National Mission on Biodiesel appear to coincide with a turn in the global biofuel tide. Biofuel has recently gained notoriety as one of the culprits of the rapid escalation in food commodity prices. According to a recent study (Mitchell 2008), global food prices have increased by 83% in the last three years. The rate of increase was particularly high during the first three months of 2008. During this period the nominal prices of major food commodities – including vegetable oils, grains, dairy products, rice, sugar and meat – are said to have reached their highest levels in fifty years (FAO 2009). According to some estimates, 65% of the rise in global commodity prices during the past three years is a result of growing biofuel production and increased demand for biofuel feedstock (Mitchell 2008).

Echoes of this scepticism around biofuel are gradually becoming apparent in India as well. In 2006, the United Nations Environment Programme (UNEP) mediated an e-forum discussion, during which contributors exchanged their initial experiences of

cultivating *Jatropha curcas* for biodiesel production.[3] Some contributors rejected the popular notion that *Jatropha curcas* requires only limited inputs, suggesting instead that plentiful irrigation and nutritional supplements are required to meet the feedstock targets set out in the national biodiesel strategy. This input-dependency implies high initial costs, which may make resource-poor farmers wary of adopting it. As such, doubts are being cast over the rural development potential of *Jatropha*-based biodiesel. Other contributors predicted further 'food versus fuel' trade-offs as already scarce natural resources, such as water, are diverted to non-food agricultural production. Some were concerned over the environmental implications of large-scale mono-crop plantations and the use of chemical inputs, which India's national biodiesel targets seem to imply. Others still questioned the classification of wastelands as 'unused', suggesting instead that such land already represents a source of livelihood for the marginalised communities.

Upon closer examination the Indian government's seemingly uncontroversial scheme that portrays biodiesel as a means of stimulating economic growth, environmental sustainability, energy security and rural development reveals itself to be the sum of several scientific and political negotiations. *The aim of this research is to trace the emergence of this scheme. In particular, it focuses on the potential of the National Mission on Biodiesel to tackle rural poverty and marginalisation in India. In the process, the research contributes to a tradition of scholarship that critically examines the apparent inevitability of technological solutions to development challenges*.

[3] Solution Exchange for Wes-Net India and Food and Nutrition Security Community: Consolidated Reply to Query on Details of Biofuels Operations. http://www.solutionexchange-un.net.in/wes.htm

In its theoretical commitments, this research reflects the growing convergence of social science disciplines. The research is situated within Science and Technology Studies (STS), which is itself an interdisciplinary field of scholarship. While STS offers the starting point for this research, concepts from other disciplines – most notably, those from development studies that explore environmental and natural resource issues – will be drawn upon to gauge specific issues. The following section provides a brief overview of the conventional understanding of the relationship between technology and society. It outlines the ways in which STS has interrogated this relationship in the past in a lead up to contemporary topics of STS analysis. Ultimately, the section attempts to persuade the reader of the value of looking at the relationship between technology and society with investigative tools from STS. It also seeks to argue that in its choice of empirical material, this thesis reflects the frontiers of thinking in the field.

1.2. Situating the research within Science and Technology Studies

Science and technology have been credited with fuelling the 'development' of societies worldwide. They are thought to have propelled the human condition "from kinship to contract; agriculture to industry; personalised to rational or bureaucratic rule; subsistence to capital accumulation and mass consumption; tradition to modernity and poverty to wealth" (Edelman & Haugerud 2005; p.2). The standing of science and technology in society is based on a Western intellectual tradition that over four centuries ago defined science as a repository of authoritative knowledge about nature, and scientists and technologists as the experts accredited with channelling such knowledge for the benefit of humanity (Sagasti 2001). According to this so-called 'Baconian programme', scientific knowledge was seen as a direct reflection of reality. In turn, technology was the extension of science into material artefacts. Both science and

technology were assumed to evolve according to an inner logic that was untainted by social, political, economic, cultural or historical contingencies. This innate rationality implied that science and technology were neutral vessels that could be employed to address societal challenges regardless of context; their application would instrumentally lead to desired outcomes.

Today, there is growing recognition that such technological determinism only partially accounts for the science, technology and society nexus. Science and technology do have impacts society, but not as the autonomous and exogenous forces implied by conventional wisdom. Nor is society a closed system with set variables; the correlation between a scientific or technological input and a societal output is rarely predictable. Upon closer examination, the image of scientists as logical operators using an abstract scientific method as a device to reflect reality also proves to be idealised. Rather, science and technology reveal themselves to embody "the circumstances of their production" (Sismondo 2004; p. 10) – commitments to particular academic theories or research methods; processes of negotiation and consensus-making within scientific communities, whose members appeal to tacit skills, social prestige and other resources in resolving debates; and even wider political allegiances. In other words, "scientific knowledge…both embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions…The same can be said even more forcefully of technology" (Jasanoff 2004; p. 2).

These stipulations form the core of contemporary STS. Early strands of STS scholarship explored the social processes of science- and technology-making. More recently, STS has turned towards examining in a more symmetrical manner how systems of science and technology emerge alongside understandings of society. This programme of

research has been encapsulated in the idiom of 'co-production' (Jasanoff 2004). The notion of co-production is an attempt to crystallise the core premise of much of past STS research by suggesting that "science…is…neither a simple reflection of the truth about nature nor an epiphenomenon of social and political interests" (*ibid.*; p. 3). Rather, science, technology and society are weaved together in a 'seamless web' of socio-technical relations (Hughes 1987). As a result, "the dynamics of politics and power…seem impossible to tease apart from the broader currents of scientific and technological change" (Jasanoff 2004; p. 14). Yet, the task of STS analysts is "to make visible the connections that co-production renders invisible" (Jasanoff 2004; p. 22).

Nascent socio-technical configurations are particularly fertile ground for STS investigations – "it is at the point of emergence, before things are completely stabilised or black-boxed that one most easily observes the mutual uptake of the social and the natural" (Jasanoff 2004; p. 287). Attempts to capture these processes often rely on detailed portrayals of the relationships and dynamics between technology and society. Such accounts exhibit particular descriptive and explanatory power. Yet, they also offer normative and predictive statements by drawing attention to "the deep cultural regularities in knowledge-making and use; by displaying the basis of institutionalised ways of knowing; by explaining what is likely to be at stake in particular identities or representations; or by showing how technical discourses may impose systematic frames of meaning on events that might otherwise seem random" (Jasanoff 2004; p. 280). The intention is not to foresee in concrete terms how the future will unfold; rather, the conclusions of research on nascent socio-technical configurations may prove valuable in avoiding some of the pitfalls of the past (*ibid.*).

Thus, STS has shown that technologies do not arise independently from a social realm to which they are then applied, but are developed in tandem with other elements of social order. Indeed, STS has argued that technologies are more than the sum of their techno-scientific components. They embody 'scripts' (Akrich 1992) or 'scenarios' (Law and Callon 1988), reflecting both the contexts of their production as well as their intended settings. Another established topic of STS research is expertise and authority. Using seventeenth century science as a case study, Dear (2004) for instance, has shown how "sanctioned social and political procedures" (p. 206) are involved in constructing an image of scientists as 'neutral experts' and an image of scientific knowledge as a source of 'definitive authority' on nature. These are mobilised to "facilitate and legitimate political arrangements or decisions" (*ibid*.).

In addition to exploring the simultaneous assembly of technologies and societies and the mediating role of experts, STS research has recently addressed the relationship between science and technology on the one hand and other, institutionalised knowledge-power formations and authoritative cultural practices on the other. These include the military (Dennis 2004), the media (Ezrahi 2004) and development (Leach, Scoones and Wynne 2005). Scoones (2006) has focused on the relationship between science, technology and development specifically within the context of India. This thesis aims to build upon such research by tracing the weaving together of biofuel (as a technological arrangement) and rural development (as a particular social order) into a seamless web of socio-technical relations in India.

1.3. Research questions, rationale and scope

Reflecting contemporary concerns of STS scholarship, this thesis is concerned with an emergent socio-technical project. By drawing on past accounts of the implementation of rural development initiatives in India, it ultimately seeks to make tentative statements as to how the project might unfold. More specifically, the research will address the following questions:

1. What narratives characterise the global biofuel discourse? What is the vision of technology and its relationship to society that underpins these narratives? How are the global narratives anchored into local realities in the case of India's National Mission on Biodiesel?
2. How are particular narratives sanctioned and stabilised over others in the National Mission on Biodiesel?
3. What do insights from the implementation of past rural development schemes suggest about the likelihood of these narratives being realised?

A range of academic disciplines have recently begun to investigate biofuels. Much of the current research tends to stem from the natural and environmental sciences or economics. For instance, De Fraiture, et al. (2008) investigate the implications of biofuel development on agricultural water use. Fargione, et al. (2008) and Searchinger, et al. (2008), in turn, estimate the effect of clearing land for the cultivation of biofuel feedstock on atmospheric carbon dioxide levels. Scholarship on biofuels in India reflects these concerns (for instance, Subramanian, et al., 2005; Mukherji, et al., 2002).

These studies present scenarios of 'biofuelled futures' using models that embed particular postulations of biofuel, land use and water availability. They are largely concerned with quantifying concepts, establishing statistical causality and producing

generalisations that can be upheld across locales. While some of this research presents data that counter previously made biofuel claims, it rarely interrogates the socio-technical assumptions implicit in the concept of biofuel itself. In contrast, this issue forms the point of departure for my research. Grounded in the qualitative research tradition of STS, it aims to expose (as opposed to impose) frames of meaning of biofuel in India, which then pave the way for further investigation. As such, the research adds an alternative perspective to the emergent stock of knowledge around biofuel.

This thesis also contributes towards the growing convergence of social science disciplines. In particular, it seeks to strengthen the bridges between Science and Technology Studies (which itself draws on insights from various academic traditions, including sociology, politics and anthropology) and Development Studies. The two fields are potentially complementary; they have approached similar questions, albeit largely in isolation of each other. Among others, both have addressed the interactions between different systems of knowledge. Within Science and Technology Studies, such research has been carried out under the banners of 'public understanding of science' and 'public engagement in science'. Examples include understanding how 'lay' and 'expert' categories of knowledge are generated and upheld, predominantly in industrialised, Northern settings (for instance, Wynne 1995). Drawing on insights from early sociology of scientific knowledge, such research has been successful in deconstructing the privileged position that scientific knowledge has enjoyed in the West since the Enlightenment and recognising the expertise of 'publics'.

Development Studies, in turn, have sought to account for the relationship between 'local' and 'expert' knowledge within the context of industrialisation. Much of this research has proceeded under the auspices of 'participatory development' (for

instance, Chambers 1983). While such research has shifted the analytical lens to the South – and highlighted the validity of 'informal', local knowledge alongside its more 'formal', scientific counterpart – it has tended to maintain expert knowledge as a black box, exploring only the socially constructed nature of local knowledge systems.

Only recently have Science and Technology Studies and Development Studies begun to merge in analyses of how 'expert' and 'local' knowledges are constructed alongside each other in development initiatives, and the mechanisms through which the former has tended to supplant the latter. The programmatic ambitions of such research often centre on redressing the power imbalance between 'experts' and 'locals' (for instance, Leach, Scoones and Wynne 2005).

Elsewhere, Keeley and Scoones (2003) have also drawn upon analytical concepts from both Science and Technology Studies and Development Studies to explore the construction of both environmental problems in developing countries and technological solutions to them. Using the case study of soil fertility management in Africa, the authors focus on the processes through which narratives around policy problems become articulated, paying particular attention to the role of scientific expertise therein. Scoones (2006), in turn, has investigated the interactions between science, politics and bureaucracy in enshrining particular visions of biotechnology into policy in India.

It is specifically upon such studies that this thesis aims to build upon. While not adhering to a formal deductive research strategy, the research picks up on the idea of policy narratives as used by Keeley and Scoones (2003) and, through this lens, investigates the global and local storylines of the problems that biofuel intends to solve.

Drawing on Scoones' analysis of the science-politics-bureaucracy interface in India, the thesis seeks to gauge the processes through which particular storylines have become embedded within the Indian National Mission on Biodiesel (2006). Finally, informed by studies by Mooij (2002) and others that have investigated the implementation of policy initiatives through networks of institutions that exist in the Indian countryside, the thesis explores the institutional milieu that is meant to act as the conduit for the rural development benefits of the scheme. Ultimately, the thesis reflects existing notions from Science and Technology Studies and Development Studies against new empirical data, thereby contributing towards the theoretical evolution of both fields.

The National Mission on Biodiesel was at the time of data collection the most prominent biofuel initiative in the country. Moreover, the initiative entailed an explicit rural development objective. Thus, *the empirical scope of the research is limited to the National Mission on Biodiesel and its 'pro-poor' claims*.

1.4. STRUCTURE OF THE DISSERTATION

The remainder of this dissertation is divided into five chapters.

Chapter 2 introduces the topic of biofuel and situates the National Mission on Biodiesel within the political and economic settings of India. Contemporary India is often described as paradoxical. On the one hand, India is among the most rapidly growing economies of the world. Moreover, in recent years India has made significant strides in information and communications technologies, biotechnology and space exploration. Simultaneously, however, approximately a third of India's population lives below the national poverty line. A further defining feature of the country is the diversity of its

population. A myriad of caste, class, religious, regional, ethnic and linguistic affiliations are coalesced under 'the Indian identity'. These affiliations often reflect upon central and state-level political cultures. Over the decades, the role of the central government has shifted from intervention to regulation and the autonomy of individual states has grown. As a result, states have become important political arenas in their own right, and they have begun to form distinct political cultures. The growing privatisation of India's economy adds a further layer of complexity to political practices in India, including those that intersect with technology and development.

Chapter 2 also introduces the methodology of this research. This research adopted a qualitative approach towards data collection and analysis. The research material was collected primarily through documentary analysis as well as informal and semi-structured interviews with Indian biofuel stakeholders during two separate field visits to India.[4] The research investigated an emergent topic, and therefore demanded an open-ended research strategy that could accommodate unexpected empirical developments. In the event, the National Mission on Biodiesel was scrapped in August 2008. By this time, the collection and analysis of data had already taken place. The concluding chapter reflects upon the abandonment of the National Mission on Biodiesel in light of the analysis in the thesis.

The open-ended nature of the research made it difficult, or indeed undesirable, to commit to any one theoretical perspective at its inception. Instead, the investigation drew on so-called sensitising concepts (Blaikie 2000) from multiple theoretical stances. Sensitising concepts enable researchers to remain open to new ideas or unanticipated findings, while still providing some direction in the selection, collection and analysis of

[4] January-February 2007 and August-November 2007.

data. Chapter 2 also explores the terms of engagement between theory and data. The two are essentially played off each other throughout the thesis. Initial data were reflected against existing theory, which prompted further questions and a new cycle of data collection and analysis. Blaikie (2000) terms this approach 'abductive research' and traces its roots in grounded theory (Glaser and Strauss 1967; Strauss and Corbin 1999).

The subsequent three chapters are thematic in nature; each chapter is built around one of the three research questions. The chapters begin with brief literature reviews, which situate the question within a particular theoretical and empirical setting. As a result, the thesis does not have a single 'literature review' section.

Chapter 3 can be read as an introduction to biofuels and the debates that have taken place around them. It has two main aims: firstly, to identify the vision of technology and its relationship to society that is implicit in global biofuel discourse, and to comment upon this critically. Secondly, the chapter will explore the local manifestations of this debate, and the interactions between 'the global' and 'the local'. The chapter finds that the challenges that biofuels seek to resolve have been framed in modernist terms, making a technological intervention seem virtually inevitable. Moreover, although there are commonalities between the global and the local debates, the latter – and, specifically those around the National Mission on Biodiesel – reflect the unique circumstances of the Indian context. The chapter identifies two particularly dominant biofuel narratives within the National Mission on Biodiesel. On the one hand, biofuel has been framed as *a new technology for the poor, capable of addressing poverty and marginalisation*. Simultaneously, it has been articulated *as a tool that can contribute towards India's macro-economic growth and energy security*. This leads up to the

subsequent chapter, which explores how these two visions have become enshrined in the National Mission on Biodiesel.

Chapter 4 takes as its point of departure Indian traditions of science policy-making and development. It begins with an investigation of the role of science and technology in India's post-independence era. 'A scientific mindset' informed the leadership of newly independent India, which in turn gave rise to a technocratic style of policy-making and -implementation. An elite community of experts analysed problems and defined solutions on the basis of their specialist knowledge. In the past, the technocracy was composed of public sector 'science czars', civil servants and their political patrons. However, the Indian political economy has evolved considerably in the intervening decades. The importance of science and technology has not diminished. Rather, a wider cast of actors is now seen to have a stake in policy processes. They include private sector scientists, entrepreneurs as well as civil society members – both home-grown and foreign.

It is this milieu of multiple and dispersed centres of influence that gave rise to the National Mission on Biodiesel. Drawing upon interview material, Chapter 4 attempts to gauge the deliberations that took place during the formulation of the Mission. The chapter identifies a tension between the new, broader cast of science policy actors and India's technocratic past: does the enrolment of a wider range of stakeholders into policy processes represent an erosion of the technocratic tradition, or do such processes continue to be dominated by elites?

Chapter 5 explores the means through which the National Mission on Biodiesel intended to realise its 'pro-poor' ambitions. The chapter examines a terrain of diverse

local governance institutions, which are meant to act as the conduits for rural development initiatives in India. However, policies are not simply 'put into practice' in this environment. Rather, they continue to be negotiated, contested and shaped on the ground. As a result, policy initiatives may have unforeseen consequences – both positive and negative. By tracing the fate of past rural development schemes in the context of local governance institutions in India, the chapter challenges the instrumental relationship that is thought to exist between policy intentions and development consequences. The chapter focuses on the state of Andhra Pradesh to explore how the historical, cultural, economic and social circumstances of the state have given rise to a particular political culture that is reflected in local governance institutions. The chapter finds that in Andhra Pradesh, these institutions are often dominated by local elites, thereby compromising their capacity to deliver benefits to marginalised groups.

Chapter 6 concludes the discussion. Among the key findings of the thesis are a series of tensions that – with the benefit of hindsight – may help to explain the eventual abandonment of the National Mission on Biodiesel. Firstly, the underlying premises upon which the Mission was articulated were contested. Debate centred particularly on the performance of *Jatropha* and the status of so-called 'wastelands'. Secondly, an analysis of the policy processes around the National Mission on Biodiesel revealed a conflict between past technocratic and more recent participatory practices. A similar strain appeared between a tradition of centralised decision-making, and decentralisation processes that sought to devolve decision-making authority to local levels.

Finally, the National Mission on Biodiesel sought to achieve both 'pro-growth' and 'pro-poor' goals. While the two need not be mutually exclusive, the likelihood that the latter would be met was compromised on at least two accounts – the domination of private sector interests during deliberations; and plans to channel the 'pro-poor' impacts of the Mission through a system of institutions that have been shown to be less than efficient in delivering accountability to marginalised groups. Indeed, in the event, the initiative was abandoned due to 'land-grabbing' by private (and often international) firms.

CHAPTER 2: CONTEXT AND METHODOLOGY OF RESEARCH

2.1. INTRODUCTION: AN OPEN-ENDED APPROACH TO AN UNFOLDING TOPIC

This chapter introduces the research context and sets out the research methodology. India is among the countries that are actively supporting the development of biofuel. Indian efforts are motivated by several factors, including the rapid economic growth that the country has witnessed in the past two decades. This has left India 'energy-hungry' as it seeks to sustain its economic expansion. Simultaneously, however, a 'global environmental debate' (Yearley 1996) has begun to take place in international political circles, and there is widespread acknowledgement of an 'environmental crisis'. Even those – primarily industrialising – countries that may not have contributed to the current environmental scenario are compelled to take action to prevent its escalation.

Indeed, India appears to have opted for a two-pronged approach in terms of its response to global environmental debate: on the one hand, it maintains its right to draw on the necessary resources to follow the path of industrialisation and economic development paved by the advanced economies of the North; on the other, India projects itself as a hotbed of scientific and technological prowess, which it can bring to bear in leapfrogging over the environmentally damaging stages of standard industrialisation.

A further – but no less important – rationale for India's enthusiasm for biofuel is its commitment to revitalising the agricultural sector, which has been trailing behind the

rest of the economy in terms of growth. Over half of India's population derives its livelihood from agricultural activities, making its regeneration an urgent domestic political issue.

India as a country is often characterised as paradoxical and complex. This chapter explores some of these paradoxes and complexities in efforts to depict the contemporary political economy of the country and the emergence of The National Mission on Biodiesel within it. The paradigm of planned, centrally-controlled social and economic development is well-established in India. However, a paradigm shift might be on the horizon. In recent decades, the Indian economy has experienced a spate of reforms aimed at its liberalisation. The New Delhi-based central government has withdrawn from traditionally public spheres of activity, and the private sector and civil society – both domestic and international – have begun to fill the void. Simultaneously, individual states have gained greater authority in steering their own affairs, and some states have opted to devolve this authority further to 'grassroots' levels. The result is a diffuse web of actors and interests that is beginning to challenge the standing of a single node of power.

In addition to introducing the context and topic of research, this chapter also describes the research methodology. The specific initiative under analysis – the National Mission on Biodiesel – was at the time of data collection an emerging topic. As such, the research relied on an open-ended approach in order to accommodate changing circumstances. Indeed, it was the novelty of the topic that gave rise to both the strengths and weaknesses of the research design. The research generated an account of a contemporary phenomenon that had not yet been studied extensively; simultaneously, there were risks that due to the novelty of the initiative, sufficient data

would not be available, or that developments would take place that might render the research questions obsolete. In the event, shortly after the completion of the research period, Indian media reports suggested that the National Mission on Biodiesel had been scrapped and replaced by an alternative scheme. However, since the research questions were designed to generate an account of *the emergence and feasibility* of the National Mission on Biodiesel, they remained valid despite the new circumstances.

The chapter is structured as follows. Section 2.2 provides a brief overview of the contemporary political economy of India and the positioning of the biofuel development within it. Section 2.3, in turn, introduces the topic of research. It reviews biofuel in general and the National Mission on Biodiesel in particular. Section 2.4 will explore the methodology of the research in more detail. The section pays particular attention to the relationship between theory and data. It also explores the philosophical underpinnings of the research strategy and their implications for the role of the researcher. In addition to outlining the nature of the inquiry, the section also sets out the means of data selection, collection and analysis. Section 2.5 concludes the chapter.

2.2. Setting the scene: the complexities and paradoxes of India

Most academic texts on contemporary India describe the country as paradoxical and complex. India's rural areas are characterised as 'agrarian' and 'poverty-ridden' and stand in contrast to the country's recent advances in information and communication technologies, biotechnology and space exploration. The Indian economy is one of the fastest growing in the world; yet one-third of its population lives below the poverty line. Simultaneously, the country holds its Gandhian past in the highest regard, while sabre-rattling its nuclear arsenal. India as a nation-state is relatively young, yet the

roots of its civilisation trace back to 2600 BC. This civilisation has formed the foundations of four religions – Hinduism, Buddhism, Jainism and Sikhism (Ganguly and DeVotta 2003).

India gained independence from Britain in 1947, and its constitution laid out a vision of a modern, sovereign, democratic, federal, socialist and secular country (Corbridge and Harris 2000). India is home to over one billion people – approximately one-sixth of the world's population – who belong to distinct yet partly overlapping caste, class, religious, regional, ethnic and linguistic communities (Census of India 2001). The caste system is based on Hindu scriptures and stratifies Indian society into largely occupation-based categories (Pingle 2003). Although originating from Hinduism, India's other major religious communities – Muslims, Buddhists and Christians – have also been influenced by caste demarcations. The importance of caste in social, economic, political and ritual practice was thought to have diminished since India's independence; however, caste identities have recently become the basis of equality measures, and caste-based politics have taken on a new lease of life (*ibid*.).

In his book "Following the Equator: A journey around the world", Mark Twain described India as 'a millionaire in religion' (Twain 1897). India's religious spectrum includes Hinduism, Islam, Christianity, Sikhism, Buddhism, Jainism, Zoroastrianism, Judaism and tribal religions (Census of India 2001). Approximately 80% of the population identifies itself as Hindu, while 13% consider themselves Muslim and 2% describe themselves as Christian. India has 22 official languages, covering four major language families – Indo-European, Dravidian, Austro-Asiatic and Tibeto-Burman. The individual languages largely map onto India's 28 states and seven union territories,

which exist under the country's federal system. A map depicting India's federal states is shown in figure 1.

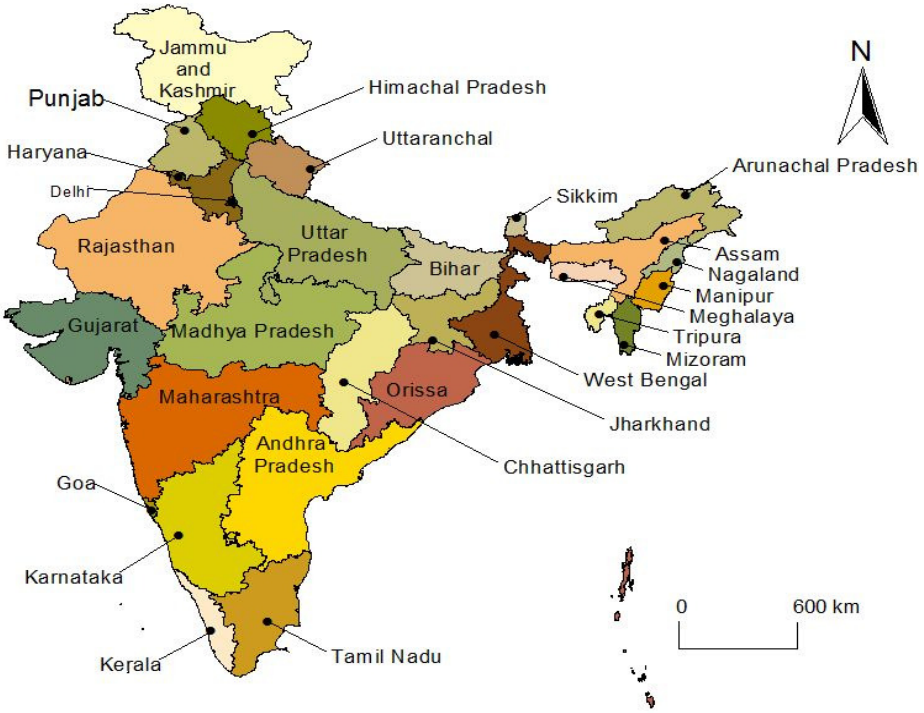

FIGURE 1 MAP OF INDIA

Given that this research touches upon the intersection of science, development and policy, it is worthwhile spending some time exploring further facets of India's political culture. India is frequently touted as the world's largest democracy; yet its commitment to a democratic system of government has been described by some as 'an anomaly' (for instance, Kohli 2001). Despite the absence of socioeconomic determinants that are conventionally thought to give rise to and sustain democracy – high levels of industrialisation, an advanced economy, an ethnically homogeneous population, and

low levels of poverty and illiteracy – India's democratic system has gone largely unchallenged since the country's independence.

Various interpretations exist as to the roots of Indian democracy. Some scholars argue that its scaffolds were constructed during the colonial era (Weiner 1989; as cited in Kohli 2001). The legacies of colonial rule are said to include a centralised state and clear political order; an extensive and efficient civil service; regular elections; and a culture of liberal democracy among the political elite. Other scholars have accredited the nationalist movement and its leaders with establishing a democratic system in newly independent India (for instance, Varshney 1998). They are said to have succeeded in forging a culture of inclusive politics and a unifying 'Indian' identity that appealed to the populace at large, beyond a small community of elites.

India's first prime minister, Jawaharlal Nehru, is said to have been committed to the principles of democracy and he was determined to instate a democratic political system in India (Kohli 2001). He was able to build upon the support enjoyed by the Indian National Congress – the political party that was home to a number of India's nationalist leaders and that has, until recently, remained a dominant force in national-level politics – and successfully enrolled rival political movements under the Congress banner. Nehru also gained the allegiance of the civil service, which ensured the effective functioning of government. Government opposition in the early years of independence was minimal due to low levels of political mobilisation (*ibid.*). Indeed, what would in subsequent years become a vibrant civil society was still in its infancy. Class conflict was rare: "vertical ties of patronage and dependency" (*ibid*; p. 17) existed among lower-caste, landless peasants and the landowning, upper-caste elites.

The status quo was disrupted in the mid-1970s and mid-1980s. The population had grown significantly and become more politically empowered. India's economy had begun to expand and political activism to take root. These events were reshaping the traditional ties between various social classes. New elites were emerging and the dominance of the Indian National Congress was coming under challenge. Despite the economic expansion, the majority of India's population remained poor. The Congress Party tried to regain its standing by campaigning on a populist message of poverty reduction. However, it failed to substantiate its election promise and opposition against the party and in particular its leader – Indira Gandhi – began to grow. Gandhi responded by imposing a 'state of emergency' between 1975 and 1977. During this period, power was consolidated from the federal states to the central government and the civil service became increasingly politicised. Democracy in India was temporarily interrupted (*ibid*.).

The period since the early 1990s has been characterised by a search for an alternative power structure that can replace what is seen as a weakened Congress Party (*ibid*.). Among the political challengers that have emerged are, firstly, the Bharatiya Janata Party (BJP) and secondly, a range of regional parties especially in the southern areas of the country. The BJP is a religious and nationalist party that situates itself on the political right. Although it has traditionally appealed to the Hindi-speaking northern and western areas of the country, it has recently broadened its appeal among the wider electorate by casting itself as the torchbearer of effective and non-corrupt politics. In turn, the regional parties tend to vary in their political leanings. Their identities are largely forged around regional languages and ethnicities. One of the most prominent regional parties is the Telugu Dessam Party of Andhra Pradesh, which since its

establishment in the early 1980s, has challenged the hegemony of the Indian National Congress in the state.

What explains the continuance of India's democracy in light of the diversity of India's caste, class, ethnic, linguistic, literacy and economic divisions? One suggestion is offered by the style of politics both on the national scale as well as in individual states, which is 'radical in tone, conservative in practice' (Kohli 2001): "While the rhetoric of the Indian state has often been redistributive – socialism, abolition of traditional privileges, reform of the caste system, and populism – political practice has been considerably more conservative, eschewing any decisive redistribution" (*ibid.*; p. 2). According to Kohli, this has resulted in elites feeling "well served by the system" while "weaker groups do not feel totally excluded or hopeless". Importantly, what redistribution has taken place has had less to do with wealth than status and dignity (*ibid*.).

Indeed, Indian society remains highly stratified, despite constitutional calls for "equality of status and of opportunity" (Weiner 2001; p. 193). It is commonly thought that the stratification of Indian society traces its roots to the caste system, whereby society is organised according to a hierarchy of inherited and occupation-based categories (for instance, Béteille 1997). Referring to this tradition, Weiner (2001) comments that "perhaps no other major society in recent history has known inequalities so gross, so long preserved, or so ideologically well-entrenched" (p. 194).

The nationalist movement campaigned for the abandonment of the caste system. The early leaders of independent India believed that a democratic system would allow Indian society to overcome divisions not only according to caste, but also other identities. Yet, what resulted was the exact opposite: "an incentive for political

mobilisation along the lines of caste, religion and language" (Weiner 2001; p. 198). Politicians today "pick and choose which identity they want to use as the basis for political and social mobilisation. Whichever identity they emphasise, the rhetoric is invariably one of 'social justice' and 'equality'" (Weiner 2001; p. 208). Echoing this argument, Jenkins (1999) suggests that Indian politics are one of accommodation: the complex trade-offs between different groups are negotiated through electoral bargains and strategic deals. It is practices of radical rhetoric and conservative practice, alongside the evocation of group identities and inequalities between them, which help to explain how popular support has been secured and sustained for initiatives that are framed, designed and implemented by elites (*ibid*.).

The economic reforms of the early 1990's are often cited as an example of such initiatives (for instance, Jenkins 1999). In brief, these increased the fiscal and administrative independence of the states and their need to secure foreign investment directly at the state-level. They also marked the erosion of centrally-planned and funded programmes as the central government became less interventionist and more regulative. Finally, the private sector became increasingly influential and knowledge-based industries began to gain political backing at the expense of more traditional economic activities (for instance, Jenkins 1999; Suri 2002; Mooij 2005). These reforms have been described as a 'partial neo-liberal turn' (Mooij 2005). The agricultural sector, for instance, remained relatively unchanged.

These reforms are credited with expanding the Indian economy at an unprecedented pace (World Bank 2008a). This rapid economic advancement appears to have brought in its wake various challenges for India's energy security, environmental sustainability and rural development. India has become 'energy-hungry' as it seeks to sustain its

economic expansion, and it has turned to renewable energy technologies in efforts to satisfy its appetite. Renewable energy is said to offer a detour through which developing countries can bypass the environmentally detrimental impacts of 'orthodox' industrialisation. However, the rationale for developing renewable energy in India goes beyond energy security and environmental considerations; it is also closely linked to tackling poverty and marginalisation, particularly in India's rural areas. One of the motivating factors behind India's efforts to develop biofuel is the revitalisation of its agriculture-dependent rural areas, which house a large and vocal proportion of the country's electorate. These ambitions are coalesced in the National Mission on Biodiesel. The following section reviews this scheme in more detail.

2.3. Introduction to the research topic

2.3.1. Biofuel

Biomass, (including fuel wood and crop residues) is currently used by an estimated 2.4 billion people worldwide to generate energy (Modi, et al. 2006). As such, the notion of biologically-based energy is not novel. Nevertheless, it has not previously been considered on such a wide-scale and in such formal terms.

While biologically-based energy can take on various forms and be used for diverse purposes– such as biogas and solid biomass for heat and power generation – it is liquid biofuels for transport that appears to dominate interests (for instance, for instance WorldWatch 2006). The interest in biofuel for transport is prompted by the relative ease of its adoption – biodiesel, for instance, is largely compatible with existing vehicle design. The production of biologically-based transport fuel also offers potentially high

profits from economies of scale. Indeed, biofuel must be manufactured in large volumes if current fuel replacement targets are to be met (WorldWatch Institute 2006; UN-Energy 2007). Biofuel is today the subject of a great deal of research that seeks to anticipate its environmental and food security impacts, as well as the economic viability of its production and consumption (for instance, Crutzen, et al 2008; Hamelinck, et al. 2005).

Biofuel refers to energy derived from biomass through processes such as solid combustion, gasification or fermentation (Demirbas 2007). These yield energy in the form of liquid or gas fuels. A range of biological sources can act as feedstock for these processes, including dedicated energy crops (such as grasses and trees), traditional crops (sugarcane and oilseed) as well as crop residues and degradable waste (maize stover, wheat straw, rice hulls and organic waste). The resulting fuel can be used in cooking, heating, electricity generation and transport (De La Torre Uguarte 2006).

Biofuel is classified as either 'first' or 'second' generation (for instance, UN-Energy 2007). First-generation biofuels are derived from oils and fats or carbohydrate-rich sources (for example, sugar and starch) using so-called 'conventional methods'. These include fermentation techniques that convert sugar to bioethanol; esterification processes that convert vegetable oils to biodiesel; and combustion techniques that burn woody material, animal manure and plant waste (*ibid*.). Certain first-generation production techniques and forms of feedstock have been criticised for being inefficient and for competing with food or feed production (*ibid*.). Indeed, a considerable amount of research is currently being carried out to find 'next generation' alternatives.

These second-generation biofuels span an assemblage of potential technological pathways, both in terms of feedstock and production techniques. Second-generation biofuels are envisioned to rely on dedicated feedstock for biofuel production including perennial grasses, wood, macroalgae, agricultural, forestry or municipal wastes. The main advantage of dedicated biofuel resources is said to be their ability to circumvent competition with food or feed production. Moreover, some dedicated energy crops are said to be suited to agriculturally marginal lands, thereby potentially enhancing biodiversity in the process (Tilman, et al. 2006). Macroalgae, in turn, have high oil contents, rapid growth rates and high population densities, making them potentially efficient raw materials for biodiesel production. Organic waste (such as wheat straw, wood pieces and used cooking oil) is considered a further alternative due to its widespread availability (Pin Koh and Ghazoul 2008).

Second-generation production technologies, in turn, rely on biochemical and thermo-chemical conversion. Biochemical conversion involves breaking down plants' cellulose and hemicellulose content into sugar molecules, which can then be fermented to yield ethanol. The limiting factors of this production technique include the rate of cellulose breakdown (cellulose, along with lignin, makes up much of the structure of the plant cell wall; these compounds have evolved to prevent the breakdown of these cell walls) and the rate of fermentation of hemicellulose-derived sugars. Current research focuses on optimising acid and enzymatic hydrolysis to address the former and searching for new strains of micro-organisms (such as bacteria, yeast and fungi) to facilitate the latter (Fulton, et al. 2004; Hamelinck, et al. 2005).

Thermo-chemical conversion refers to gasification (the conversion of solid mass to gas at high temperatures and low oxygen levels) and pyrolysis (the burning of biomass in

the absence of oxygen) (Pin Koh and Ghazoul 2008). The gasification of biomass yields 'syngas' – a mixture of carbon monoxide, carbon dioxide, hydrogen and methane – which acts as a precursor for fuels such as hydrogen, methanol and dimethyl ether. Syngas can also be converted into synthetic diesel and gasoline through Fischer-Tropsch synthesis. The advantage of gasification techniques is that all organic matter in biomass (including lignin, which is a limiting factor in biochemical conversion) can be processed into liquid biofuel. Moreover, biomass gasification can make use of existing gasification infrastructure. Pyrolysis, in turn, yields liquid bio-oil and solid bio-char. The former is ideally suited to fuelling boilers or stationary engines to generate heat and electricity. The latter can be added to soil to enhance carbon dioxide sequestration from the environment and to retain soil nutrients. On the downside, thermo-chemical conversion still remains costly. Consequently, biochemical methods may prove more feasible in the short-term (WorldWatch Institute 2006).

Biotechnology is said to play a potential role in unlocking some of the challenges of 'next generation' biofuels (for instance, Fulton, et al. 2004). It is a potential tool to accelerate advances in plant genomics and thereby the selection of high-yielding, less input-dependent energy crops. These may alleviate potential conflicts over land use and reduce greenhouse gas emissions associated with biofuel feedstock production. Biotechnology may also enable the engineering of energy crops that are pest-, disease- and drought-resistant, thereby guaranteeing a stable supply. Other traits that may be selected through biotechnological tools include rapid growth, low lignin-content and the expression of enzymes within the crops themselves that can enhance the breakdown of cellulose (for instance, Sticklen 2006).

2.3.2 The National Mission on Biodiesel

The notion of biofuel is not novel in India. According to Mohan, et al. (2006), as early as 1948 the Indian Power Alcohol Act mandated blending 'power alcohol' with petroleum in order to make newly independent India energy secure and to off-load the oversupply of molasses from sugar cultivation. However, the act was never fully implemented due to relatively stable global oil supplies and prices, as well as a decrease in the availability of ethanol in the subsequent decades (*ibid*.). Nevertheless, the act was not repealed until 2000 during the course of administrative reforms. This proved to be ill-timed: within two years, the Ministry of Petroleum and Natural Gas reinstated a mandate calling for 5% blending of petroleum with ethanol in nine states and three union territories. This Ethanol Blending Programme (EBP) was accompanied by a government subsidy programme for ethanol production.

The EBP has had a chequered history since its establishment. In 2004, the government seemingly withdrew the ethanol blending mandate and the ethanol subsidy only to reinstate both later in the year. However, the ethanol programme has continued to face difficulties. At the turn of the millennium, the availability of sugar molasses began to decline, and the sugar industry informed the government that the blending requirements could not be met. The government refused to revisit the EBP, citing its importance to rural development.

It is against this changeable policy backdrop that the Planning Commission in 2002 established the Committee for the Development of Biofuel. This committee was given the responsibility of devising a plan to stimulate the emergence of a coherent biofuel industry in India. In 2003, this committee published a report recommending that biodiesel should be the priority – essentially casting aside the development of bioethanol – and as a result, set about devising the National Mission on Biodiesel. This

final Mission was also published in 2003. However, it did not represent an official nationwide biodiesel policy. Nevertheless, taking their cue from the new scheme, a number of state governments began to devise their own biodiesel policies.

The National Mission on Biodiesel identified a tree that bears non-edible oil – *Jatropha curcas* – as the feedstock of choice for biodiesel development. The National Mission on Biodiesel was designed to consist of two phases. The first phase took place between 2003 and 2007 and aimed at demonstrating the feasibility and benefits of a comprehensive biodiesel industry. The government took the lead during this phase, which concentrated on setting up plantations and organising seed collection, oil extraction, processing, blending and marketing. Public events to raise awareness and acceptance of biodiesel as an automotive fuel also took place (Planning Commission of India 2003). Funding for setting up plantations was expected to come almost entirely from the government. Seed collection centres and oil extraction units were envisioned to be financed through 'margin money' (private sector investments, government subsidies and bank loans). Biofuel manufacturing units, in turn, were seen as an entirely commercial venture. Research and development were to receive funding from the government, oil companies, and the automobile manufacturers association (*ibid*.).

The second phase was set for 2007 and 2012. Its goal was the establishment of a self-sustaining biodiesel industry, backed by funds from the private sector and international donors. The government intended to recede into a more facilitative role. The combined impact of the first and second phases of the NMB was to produce sufficient quantities of vegetable oil to achieve 20% blending of biodiesel by 2020 (Planning Commission of India 2003).

The NMB called for the planting of primarily *Jatropha curcas* on selected 'wastelands' throughout the country. An estimated 13.4 million hectares of land were identified as suitable for *Jatropha* cultivation under the scheme. Under the first phase of the NMB, 400 000 hectares were to be brought under *Jatropha* cultivation in areas ranging in size from 50 000 to 60 000 hectares. These included both forest and non-forest lands (the latter refers to the marginal lands of farmers and public lands along roads, highways, canals and railway tracks). The NMB envisioned some crossover with existing rural development programmes by calling for the cultivation of *Jatropha* on lands that were part of such schemes. The NMB consisted of six specific 'micro-missions', which addressed plantations, seed collection, oil extraction, transesterification, blending and marketing as well as research and development (Planning Commission of India 2003).

In August 2008, Indian media reported that the National Mission on Biodiesel had been cancelled, and elements of it had been incorporated into a new National Biofuel Policy (for instance, The Economic Times of India; 4.8.2008). The concluding chapter reflects the findings of this research – which concluded before the Mission was scrapped – against the ultimate fate of India's biodiesel scheme.

Having introduced the topic of research, this chapter now turns towards the methodology of research. The subsequent section sets out the role of theory in the research and the relationship between theory and data. It also describes the ontological, epistemological and axiological assumptions underpinning the research. The research is qualitative – as opposed to quantitative – in nature, and the section explores the implications of this mode of inquiry for data selection, collection and analysis. It also comments upon issues of ethics and confidentiality, and includes a reflexive note on the research process.

2.4. METHODOLOGY

2.4.1. THE ROLE OF THEORY

The research was primarily guided by empirical developments – in other words, it was not concerned with deductively testing theory-derived hypotheses. Rather, the strategy that was adopted most closely resembles 'abductive' research (Blaikie 2003), particularly in its use of theory. In abductive research, theory and data are closely intertwined – "data and theoretical ideas are played off against one another in a developmental and creative process" (Blaikie 2003; p. 15). Research in this tradition is iterative. Initial empirical findings are reflected against existing literature, which may prompt particular interpretations and further questions, leading into a new cycle of data collection. By extension, data collection and analysis occur concomitantly. Rooted in grounded theory (Glaser and Strauss 1967; Strauss and Corbin 1999), abductive research aims to generate detailed, 'thick' descriptions of phenomena.

The research is primarily informed by Science and Technology Studies; however, it also draws upon Development Studies to stimulate alternative perspectives of analysis. Indeed, the unfolding nature of the empirical setting made it difficult (or indeed undesirable) to commit to any one theory at the outset. Instead, the research uses 'sensitising concepts' (Blaikie 2003) from various literatures. Widely used in grounded theory (Glaser and Strauss 1967; as cited in Blaikie 2000), sensitising devices can be thought of as compasses, providing initial bearings into unknown fields. Such concepts are particularly helpful when little is known of the topic of research at the outset – as was the case here. They allow researchers to remain open to new ideas or unexpected findings, while still providing some direction in the selection, collection and analysis of

data. When using sensitising concepts it is often necessary to 'soften' their reified boundaries in order to adapt them to the research context. Those boundaries are then reconstructed on the basis of new findings.

Chapters 3, 4 and 5 are thematic in nature, each looking towards particular sets of literatures for sensitising concepts. The concepts are not selected at random, nor are they used in isolation; rather, the chapters trace their roots and highlight the ways in which different concepts augment each other. In brief, chapter 3 draws on the notion of 'policy as discourse' in order to unpick the set of cause-and-effect assumptions – or narratives (Roe 1991) – that are used to justify biofuel. Chapter 4 takes as its point of departure the concept of 'technocracy' (Fischer 1990) to explore connections between expertise, authority and policy. It is also informed by 'policy process' literature within the context of science-based development interventions (Keeley and Scoones 2003; Scoones 2006) to explore how particular narratives of biofuel – identified in the previous chapter – have become embedded into the National Mission on Biodiesel. Chapter 5 also builds on 'policy process' literature, albeit this time within the context of rural development in India (Mooij and de Vos 2003). It investigates the decentralised institutional setting through which the National Mission on Biodiesel intends to achieve its rural development objectives (World Bank 2000; Jayal, et al. 2006; Johnson 2003).

2.4.2. PHILOSOPHICAL UNDERPINNINGS

In order to convey the status of the knowledge that any research produces, the research design must lay out its ontological, epistemological and axiological assumptions. If ontology is thought of as describing 'the status of the real world', epistemology reflects 'the status of the knowledge of that world'. Axiology, in turn, conveys the worldviews, values and commitments that may influence the emergence of that knowledge

(Creswell 2007). These concepts are perhaps best illustrated by contrasting scientific and social scientific knowledge.

Scientific knowledge is widely perceived as directly reflecting a material world that exists independently of the consciousness of the 'knower' (realist ontology). Such knowledge is thought to be derived from the application of a rational and objective scientific method – a systematic set of means through which the material world can be probed to reveal its truths (a positivist epistemology).

Most social scientific fields – STS included – question this pervasive view, suggesting instead that science and technology constitute social activities alongside many others. As such, scientific knowledge claims and technological artefacts are thoroughly "human products...marked by the circumstances of their production" (Sismondo 2004; p. 10). It is not an inherent quality of scientific knowledge claims – nor any 'logical' procedures that scientists follow to produce them – that determines their credibility; rather, rhetorical tools reflecting commitments to particular theories and practices, or indeed wider societal standpoints, become mobilised in the construction of consensus (often understood as 'truth') around scientific knowledge claims and technological artefacts.

Anchored in STS, this research adopts the discipline's constructivist outlook on epistemology. The Edinburgh School of the Sociology of Scientific Knowledge is widely credited with establishing the foundations of contemporary STS. The Edinburgh School insists on analytical reflexivity – that is, the explanatory frame must be applicable to both accounts of scientific and social scientific scholarship (Bloor 1991). In this tradition, my research has 'created sociological realities' as opposed to 'represented social realities'. I have been a reflexive partner in the research process, bringing to it

personal worldviews, values, educational and professional commitments (Blaikie 2003). All knowledge being taken as contingent (including that produced within STS), it is necessary to make 'the circumstances of its production' (or my 'axiological' standpoints) explicit at the outset of the research in order to facilitate the robustness of the analysis.

During the course of my academic training and work experience to date, I have developed an interest in the roles of science and technology in agricultural development in the South. I have carried out periods of fieldwork in East Africa and South Asia; experiences that have revealed the politically charged nature of science and technology in development processes. I believe that STS is particularly well-equipped to unravel the mobilization of science and technology in such processes, because it prompts the analyst to subject *all* scientific and technological claims and artefacts – whether contested or uncontested – under investigation in order to unravel the locally-specific meanings, values, motivations and interests, which underpin them. At the outset of this research, I was neither ardently 'pro' nor vehemently 'anti' biofuels. While I reject any notion of absolute impartiality, I made every attempt to evaluate all of the data that I gathered equally critically. I explore my role as a reflexive partner in the generation of data further in section 4.8.2, which provides 'post-script' on the research process.

Finally, in social science ontological questions centre on whether there exists a single social world or multiple social worlds. Most contemporary social scientific disciplines reject the notion that there is a unitary social world; rather, they recognise that multiple social worlds can exist in parallel. Social scientific research seeks to

characterise those worlds through individuals' experiences of them (Blaikie 2003). My ontological commitments reflect those of the social sciences more broadly.

2.4.3. NATURE OF INQUIRY

I was interested in acquiring an understanding of the contingent meanings that biofuel and rural development have in India, and how these motivate and inform the practices and processes underlying the National Mission on Biodiesel. It is by virtue of these concerns that a qualitative approach to research appeared most appropriate. Indeed, Blaikie (2003) maintains that "the chief characteristic [of qualitative research] is a commitment to viewing...social action and events...from the viewpoint(s) of the people being studied…discovering *their* socially constructed reality and penetrating the frames of meaning within which they conduct their activities" (p. 251; emphasis in original). In contrast, quantitative approaches tend to impose pre-existing social scientific categories on the topic of study, thereby being ill-suited for the aims of my research.

There are a number of other features of qualitative research that warrant its application my research. Blaikie (2003) suggests that "qualitative researchers view the social world as processual rather than static" (p. 252). This research is explicitly concerned with capturing some of the dynamics of the emergence of a biodiesel initiative in India. Moreover, both Blaikie (2003) and Creswell (2007) highlight the 'flexible approach' and 'emergent design' (respectively) of qualitative research whereby "the initial plan for research may change or shift after the researchers enter the field and begin to collect data" (Creswell 2007; p. 39). As mentioned previously, the evolving nature of the research topic necessitated precisely such a design. Finally, both Creswell (2007) and Snape and Spencer (2003) suggest that a qualitative approach is relevant for research that draws on "samples that are small in scale and purposively

selected on the basis of salient criteria" (the latter; p. 5), which was the case in my research. The following section explores how the boundaries of research were defined and how the relevant data were identified.

2.4.4. DATA SELECTION

Blaikie (2003) adopts the notion of 'a case study' to provide the heuristics for demarcating the data to be collected during research. This contrasts with other authors, who employ the term to refer to particular research methods (for example, Gillham 2000) or a research strategy in its own right (for instance, Yin 1994).

Although I did not intend to view my entire research design through the lens of a case study, my research was informed by Yin's definition of the concept. He describes a case study as involving research on a current phenomenon that is not subject to control by the researcher; that is inseparable from its context; and that can be defined as a sustained process. The research was, thus, a case study of the emergence of a novel 'technology for development' initiative – the National Mission on Biodiesel (NMB) – in India.

Returning to Blaikie's definition of a case study, I assumed that the boundaries of my research would became better defined during the course data collection and analysis, given the unfolding nature of my research topic. Nevertheless, I was able to draw some initial borders. The choice of India as the location of data collection was motivated by several factors. India is among the countries that was most actively pursuing a national biofuel programme. At the time of field work, the first five-year phase of the National Mission on Biodiesel was nearing completion, suggesting that sufficient empirical material would be available in the country. A component of the research sought to

explore the planned implementation of the National Mission on Biodiesel at a more specific, state-level. Andhra Pradesh provided this setting due to the vast scale of biodiesel activity taking place in the state. Its government had established a separate department[5] responsible for implementing eventual national- and state-level biofuel policies. Moreover, Andhra Pradesh hosts a number of agricultural research organisations involved in *Jatropha*-specific projects.[6] A range of private sector organisations were also entering *Jatropha* cultivation and processing in the state.[7] Finally, I had previous research experience in Andhra Pradesh, and had secured office space and academic support for the duration of my fieldwork from my previous employer.[8] If fieldwork in Andhra Pradesh had become infeasible due to unforeseen circumstances, I also scoped biodiesel developments in the states of Tamil Nadu, Uttar Pradesh and Chattisgarh, which could have acted as alternative research locales.

The conceptual nature of the research was limited to biodiesel as a new technology for rural development. A comparatively mature, yet distinctly smaller-scale, bioethanol sub-sector that is based on carbohydrate-rich crops (such as sugarcane and sweet sorghum) already exists in India. However, the rural development goals of bioethanol production have not been articulated as explicitly as those of biodiesel. Consequently, an investigation of bioethanol development may not have provided the empirical material required to answer how biodiesel will improve the livelihoods of marginalised communities in rural India.

[5] The Rainshadow Areas Development Authority.
[6] Including the Central Research Institute for Dryland Agriculture (CRIDA) and the International Crop Research Centre for the Semi-Arid Tropics (ICRISAT).
[7] These include Nandan Biomatrix, Southern Online Biotechnologies and British Petroleum.
[8] UNU/ MERIT; Learning, Innovation and Knowledge (LINK) –programme based in Hyderabad.

The population of interest could not be definitively identified at the outset of my research. I worked on the premise that the population would include the actors mentioned in the NMB document. In other words, I sought contact with central government- and state-level policy-makers; private sector firms; non-governmental organisations and community-based organisations; farmer associations; and agricultural and energy research institutes. However, I remained aware of the possibility that other stakeholders could also be implicated in the National Mission on Biodiesel and anticipated that I would come to know of them as the research unfolded.

Having sketched the initial boundaries of the population of interest, I now had to identify the most appropriate means of sampling it. I turned towards 'purposeful sampling', which refers to the selection of data units that exhibit features salient to the research topics (for instance, Ritchie, et al. 2003; Creswell 2007). Purposive sampling is appropriate when the research does not aim to make statistical generalisation on the basis of random samples; rather, it yields qualitatively-based, contingent theories of social phenomena. I initially approached those social actors, who had been involved in biofuel policy advocacy, formulation and/or implementation; *Jatropha* research, cultivation, collection, processing and use; as well as those who had participated in consultative exercises or otherwise deliberated *Jatropha*-based biodiesel in public fora such as the media. These contacts referred me to other individuals and organisations that they felt could be relevant to my study. This particular form of purposive sampling – snowball sampling – also allowed me to clarify the population of interest through the perspectives of actors themselves.

2.4.5. DATA COLLECTION

Although my unit of analysis was a single case, there were a number of activities, processes, events, times, locations and actors to be examined within it (Miles and Huberman 1994). I collected data from documents (including academic journals, policy papers, reports, project reviews, media items, e-mails and websites); through interviews with key informants and visits to field trials and pilot projects; as well as by attending conferences and workshops on biofuel development in India. Consequently, I generated micro-level data on individuals, small groups and social episodes; meso-level data on organizations, communities and social movements; and macro-level data on social institutions and structures, nations and multinational bodies. The data was primary (generated by me), secondary (generated by another researcher) and tertiary (generated and analysed by another researcher) in nature. I collected it mainly in semi-natural settings, such as in offices or at conference venues, although I also visited cultivated fields and pilot plants (natural settings) (Blaikie 2003).

I initially intended to draw upon in-depth and semi-structured interviews, focus groups and documentary analysis as the means of data collection. I was motivated by a belief that the use of multiple methods would allow me to obtain a comprehensive understanding of the National Mission on Biodiesel. This is in contrast to another common rationale for the use of multiple methods – triangulation. This has been associated with a realist ontology, whereby a single social reality is probed from different perspectives using a range of methods, which then converge to reveal 'the true nature' of the social phenomenon in question (Blaikie 2003). Triangulation in this sense has been seen to reduce bias and improve validity of research, echoing a positivist epistemology. In contrast to the philosophical underpinnings of 'triangulation', I assumed the existence of multiple social realities from the outset, and viewed knowledge thereof as temporally and spatially contingent. As such, my reasons

for using multiple methods was better described by the notion of 'crystallisation', whereby "what we see depends upon our angle of repose" and each angle provides "a deepened, complex, thoroughly partial, understanding of the topic" (Richardson 1994; p. 522, as cited in Blaikie 2003; p. 270).

In practice, arranging focus groups proved infeasible – those individuals who indicated a willingness to participate in a focus group were widely-dispersed throughout India and it appeared difficult to agree a suitable time and place for the exercise. In hindsight, a conference call using Skype or equivalent software may have been possible. I had envisioned focus groups as a useful means of establishing new and refining existing research questions according to the frames of reference of the actors themselves. Similarly, focus groups would have been an effective means of corroborating findings by providing an opportunity for social actors to respond to and engage in dialogue about interim and final conclusions. Thus, I had intended to arrange focus groups during exploratory and confirmatory research. In the event, I tried to gauge these issues during interviews.

As mentioned previously, I saw my role as a researcher to be a 'reflexive partner' in the research process, constructing and interpreting a narrative around the research topic together with research participants. I had prepared an interview guide, which included 'ground-mapping' questions (to open up a topic) as well as 'dimension-mapping' questions (to encourage respondents to focus on particular issues within that topic) (Legard, et al. 2003). I made every effort to articulate open questions and to avoid leading the respondents with particular question structures or phrasing (Bryman 2004).

Rubin and Rubin (1995) and Legard, et al. (2003) suggest that interviews are 'guided conversations' that – while not adhering to a blueprint – follow certain stages. Ground-mapping questions often begin the interview and facilitate the establishment of meaningful communication between the interviewee and interviewer. This stage tends to be followed by a discussion on issues that require deeper contemplation on the part of the interviewee, but that are not controversial. Gradually, a common vocabulary becomes established between the interviewer and interviewee. This enables more sensitive themes to be explored in a productive manner. Interviews tend to end by interviewers bringing participants down to the level of "everyday social interaction" (Legard, et al. 2003; p.146). While recognising that every interaction would be unique, I tried to bear these stages in mind during interviews.

In the end, I carried out a total of 13 interviews with government officials, entrepreneurs, agricultural researchers, and representatives of non-governmental organisations. Moreover, a number of informal discussions took place with various stakeholders during biofuel conferences and workshops. These often provided helpful insights that I could later confirm or refute through interviews.

In addition, official documents, field trial and pilot project results, along with conference and workshop proceedings also provided valuable information. Documentary sources, however, have the drawback of not necessarily having been written for the purposes of the research in question (MacDonald 2001). Consequently, I examined not only the contents of documents, but also the circumstances under which they were produced in order to appropriately situate the data derived from them.

Temporal factors also influenced data collection decisions. The research was longitudinal in nature; it was focused on change over time. The National Mission on Biodiesel was set to run in two phases between 2003-2007 and 2007-2012. Consequently, I began the research with a period of retrospective research in order to gain a thorough understanding of the first phase of the initiative. The research was in an interesting position in that it was effectively 'synchronised' with empirical developments, and was able to follow the evolution of the National Mission on Biodiesel in real-time. As it was not my intention to follow the scheme to its completion, I also planned to carry out some prospective research, involving tentative outlooks to the near future. Given the sudden halt of the initiative at the end of the data analysis and collection period, I re-examined these tentative statements as possible explanations for the abandonment of the initiative.

2.4.6. DATA ANALYSIS

Much of the data that I collected during interviews and accessed through documents was in the form of language. Nevertheless, the research is not concerned with the detailed structure of the discourse, but instead, on the "common sense, substantive meanings" (Spencer, et al. 2003; p. 202) that it conveys. In chapter 3, I make use of the notion of 'policy as discourse'. Building on a Foucauldian understanding of 'discourse' (Foucault 1972), which is used among others in Development Studies (for instance, Escobar 1995), I take the term to refer to 'framings of the world'. In this sense, 'discourse' echoes the notion of 'paradigm', as articulated by Kuhn (1970). A paradigm provides the framework of practice for particular scientific disciplines. It encompasses the commonly-agreed upon theories, laws, experimental procedures and terminology for conducting science. My aim in chapter 3, for instance, was to characterise the

narratives that form the cornerstones of biofuel policy discourse. I employed content (as opposed to conventional discourse) analysis in order to describe them.

As outlined earlier, the research was unfolding in nature and guided by often real-time empirical developments. Consequently, I proceeded with the research in stages and carried out data collection and analysis iteratively. In this, as I mentioned earlier, I was informed by the principles of grounded theory (for instance, Strauss and Corbin 1998). I carried out phases of coding on the first set of data that I collected, and devised initial data categories. Subsequent phases of data collection and analysis yielded further categories and interconnecting them. Ultimately, I generated a narrative that formed the basis of the overall conclusions of the research (*ibid*).

2.4.7. Ethical considerations

I adhered to the ethical practices set by the Graduate School for Social and Political Studies, and carried out an ethics self-audit. I also discussed my proposal with my supervisors prior to undertaking fieldwork. These did not reveal any obstacles to carrying out the research.

At the inception of each interview I explained the purpose of my research to the interviewees, along with how their contributions related to it. I obtained informed consent and guaranteed participant confidentiality and anonymity, should the interviewees request it.

2.4.8. Reflections on the research process

I have attempted to reflect upon the research process throughout section 2.4. However, there remain a few further issues that warrant attention.

Firstly, the population of interest contained communities of 'elites', such as policy-makers and scientists (Hertz and Imber 1995). There is a notable lack of social science literature on studying such communities. Most methodological texts assume that social research is carried out on 'lay' populations, with an inherent implication that researchers are in positions of power relative to other participants. What if the power dynamics are reversed, as is often the case in studies of elites?

To begin with, interviews are unlikely to resemble conversations that are guided by the researcher (Legard, et al. 2003). Rather, they require a greater degree of steering and control. Secondly, gaining access to elite populations presents its own set of challenges. Ostrander (1995) suggests 'gaining access from the top' – that is, recruiting senior members of an elite community as key informants, who can facilitate contacts with their subordinates or with those, they consider their equals. Lastly, while all interviews require careful preparation and thorough background familiarity with the topic of interest, this is particularly important when studying elites. As Ostrander (1995) highlights, gaining access to elites does not necessarily mean gaining their trust, and a continuous process of 'being checked out' is likely to occur. A researcher's credentials are evaluated both in terms of their familiarity with the topic of research, as well as the networks that researchers may share with other research participants.

The research did not reveal any insurmountable obstacles in gaining access to the population of interest. As a result of prior work experience, I was networked into communities that study science, technology and development in India. I was able to gain initial access to relevant actors through these. My prior work experience had also

involved research among communities of elites, and I was therefore accustomed to the particular demands of such research.

Secondly, my starting point was that the National Mission on Biodiesel was deeply intertwined with its particular context. I was aware of the importance of understanding this context as fully as possible, and the potential difficulty of doing so as a foreigner. In order to try to improve my familiarity with the Indian environment, I enrolled in an intensive course at the University of Hyderabad that introduced contemporary India to foreign students specialising in South Asian Studies. The course covered a range of topics, including Indian politics, the environment, the economy, peoples and languages. I also studied Hindi at the University of Hyderabad. Although I was able to merely scratch the surface in terms of understanding contemporary India, the courses did help in situating my findings within the appropriate setting.

Field research in India carried its own set of practical considerations. Firstly, I was aware of the fact that language could be a potential barrier to data collection. In the end, however, all of my interviewees were fluent in English. I nevertheless brought sketch pads to interviews in case there were difficulties in communication. Interviewees appeared to find it helpful to illustrate issues such as institutional relationships through diagrams, and the resulting sketches proved to be unexpected and useful sources of data. Occasionally, I was also given documents in Hindi or Telugu. Staff at the organisation where I was based in Hyderabad translated these for me. Secondly, logistical challenges were inevitable – transportation infrastructure was frequently not operational, and Internet connectivity (although increasingly widespread) was not reliable. This meant that I had to factor in sufficient time for the fieldwork.

Funding for the field research came predominantly from the studentship that I had secured from the University of Edinburgh. However, I supplemented this by working as a research assistant in India for my host organisation.

2.5. CONCLUSIONS

This chapter has sought to outline the context and methodology of the research. The review of India's contemporary political economy, as well as its culture of politics, set the scene for the subsequent analysis of the National Mission on Biodiesel. This chapter also briefly introduced biofuel in general and the National Mission on Biodiesel in particular. As the subsequent chapters will argue, this ambitious, centrally-led scheme represented a continuation of India's tradition of technocratic development.

The chapter also outlined the research methodology. It presented an open-ended design towards an unfolding topic. To date, biofuel has largely been studied using quantitative methods. This research marks a departure from this trend. Instead of formulating hypotheses and accepting or rejecting them on the basis of quantitative data, the research draws upon 'sensitising concepts' to guide data selection, collection and analysis. The output of the research is a qualitative narrative of the National Mission on Biodiesel. The robustness of this narrative can be judged according to the parameters set in the research design – that is, the soundness of the relationship between research questions, data selection, data collection and data analysis. The design also signals what the research intends (and equally, does not intend) to accomplish.

The subsequent chapter is the first of three thematic accounts, which are built around each of the research questions. It seeks to unravel the vision of technology and its relationship to society that is embedded in the concept of biofuel at the global level, and the National Mission on Biodiesel at the local level.

CHAPTER 3: POWERING DEVELOPMENT WITH BIOFUEL

3.1 INTRODUCTION

Biofuel has carved out a distinct space for itself on the international political agenda, and it is rapidly gaining purchase among a range of communities. Various countries and regions have established biofuel policies and incentives – notably, transport fuel replacement targets – to stimulate the development of biofuel sectors both at home and abroad. In today's vernacular, 'alternative' or 'renewable fuels' have become virtually synonymous with biofuel. Moreover, biofuel technology is evolving rapidly. Yet, the fast-pace of technological change appears not to have dampened conviction that it will give rise to manifold societal benefits. Indeed, biofuel has been cast as a single policy tool – or, an assemblage of technological options – that will instrumentally lead to multiple policy goals. As such, it evokes notions of 'technological determinism' and 'modernisation', which frame societal challenges in technicist terms and present scientific and technological interventions as virtually inevitable. Science and technology are thought of as universal and autonomous forces, which power societal change regardless of local contingencies.

This chapter builds on studies that have investigated the construction of policy problems, particularly within the domain of 'environment and development' (for instance, Keeley and Scoones 2003; see also Fairhead and Leach 1997). These take as their starting point the notion of 'policy as discourse'. This analytical lens casts policy as a series of assumptions – or 'narratives' – which act as organising principles for policy formulation and implementation. Such narratives are akin to storylines with

distinct structures; they proceed from diagnosing a policy problem to prescribing a policy solution.

Accordingly, this chapter approaches biofuel as a policy solution that is based on deeply held assumptions about rural development, agriculture, climate change, the environment and trade. These assumptions are stringed together into narratives of the crises or challenges that biofuel will redress. This chapter will 'work backwards' from policy prescription to policy diagnosis in order to identify and critically examine the narratives that are embedded into biofuel policy discourse. In other words, the chapter asks "what are the challenges that biofuel will seek to resolve?"

Keeley and Scoones (2003) argue that policy narratives – particularly when they operate on a global scale – are often 'simplistic' and 'stark', giving the impression of widespread consensus around the assumptions on which they are built. Such apparent straightforwardness, they argue, allows a range of communities (with otherwise potentially divergent interests) to buy into policy initiatives and for those initiatives to be implemented on a vast-scale. The authors caution, however, the "while the logic that flows from [policy narratives] may be good, it is nevertheless the case that if the first premise is flawed, then whole courses of action, plans, programmes and policies can arise that are, at root, misconceived" (p. 41).

The chapter presents an analysis of recent policy stances and reports[9] to identify the main benefits that biofuel is said to confer, in the process unearthing a series of assumptions that underlie these expected outcomes. Upon closer examination,

[9] Fulton, et al. (2004); UN-Energy (2007); Kojima and Johnson (2005); Dufey, et al. (2007); WorldWatch Institute (2006); Cotula, et al. (2008)

however, the assumptions prove to be contested. As Keeley and Scoones suggest, the presence of such critical stances problematises the apparent inevitability of biofuel-mediated societal change. Ultimately, the chapter explores a more nuanced understanding of the technology-society interface that these contested narratives imply.

A second aim of the chapter is to explore the local groundings of global biofuel discourse in India, particularly as it pertains to the National Mission on Biodiesel. Some stances on 'policy as discourse' view global narratives – especially those that infuse science with development – as monolithic and totalising (for instance, Ferguson 1992; Escobar 1995). While providing compelling accounts of the interactions between knowledge, power and policy, such analyses have been critiqued for dismissing the agency that exists in localities (Keeley and Scoones 2003). The authors acknowledge that, in places, global narratives do sculpt local debate and planning to a large extent. However, they equally maintain that "in others, there may be more negotiation [of the global] in order to reflect local knowledge, local interests and local complexity" (p. 68). How does Indian biofuel discourse – particularly as it has pertained to the National Mission on Biodiesel – reflect against these findings?

The discussion is structured as follows. Section 3.2 expands on the notion of 'policy as discourse', which acts as a sensitising concept for the analysis in this chapter. Section 3.3, in turn, outlines 'the biofuel solution' in anticipation of section 3.4, which unearths the narratives that form the building blocks of global biofuel policy discourse. In the process, the analysis reveals a set of counter-narratives, which appear to cast doubt on the certainty of biofuel-mediated social change. Section 3.5 explores the vision of technology and its relationship to society that underpins these narratives and their

critical counterparts. Section 3.6, meanwhile, reflects the national biofuel landscape of India its global counterpart. Section 3.7 explores the connections between 'the global' and 'the local' further, while section 3.8 concludes the chapter.

3.2. POLICY AS DISCOURSE

The analysis of 'policy as discourse' is a well-established tradition within Development Studies (see, for instance, Grillo and Stirrat for case studies). 'Discourse' itself is a complex notion that can be explored on different levels. Within linguistics, discourse has conventionally been analysed on a micro-level. Such analysis has been concerned with the detailed structure of language and the flow of verbal exchanges (Grillo 1989). Within Development Studies, however, the tendency has been to examine discourse as 'higher order linguistic practices' (*ibid*.). The definition of 'discourse' by Hajer (1995) is pertinent here. The author describes discourse "a specific ensemble of ideas, concepts and categorisations that are produced, reproduced and transformed in a particular set of practices and through which meaning is given to physical and social realities" (p. 44). Dryzek's use of the term is similar: "a discourse is a shared way of apprehending the world. Embedded in language, it enables those who subscribe to it to interpret bits of information and put them together into coherent stories or accounts. Each discourse rests on assumptions, judgements and contentions that provide the basic terms for analysis, debates, agreements and disagreements" (1997; p. 8).

What is the value of approaching policy as discourse? Apthorpe (1996) suggests that this lens problematises the notion that policies are 'given' through logical procedures of problem diagnosis. Instead, "policy practices involve categorising the world into different sectors and areas for the purposes of managing and maintaining social order"

(Keeley and Scoones 2003; p. 37). Importantly, such practices are not value-free; rather, they are inherently human activities that reflect intimate connections between 'knowledge' and 'power' (Foucault 1973; 1980). Such connections help to explain why particular framings of policy challenges and policy solutions are granted validity over others.

Thus, the concepts used in policy discourse are not neutral. Rather, they can frequently be traced back to particular institutions and interests (Grillo 1989). Moreover, policy discourses embed assumptions that are often stringed together into simplified accounts of circumstances. These 'narratives' serve to link causal events in a sequential manner, and in the process, 'caricature realities' (Roe 1991). Although narratives may be challenged by evidence to the contrary, they persist because they offer a means of making sense of complex settings, processes and interactions. As such, they have become valuable devices in policy-making.

As narratives gain purchase among a range of communities, they become programmatic, forming the basis of 'blueprint practices' or standard procedures for addressing particular challenges. The premise of this chapter is that biofuel has become framed as a 'blueprint' policy tool, which can resolve a multitude of societal challenges. Working backwards from 'prescription' to 'diagnosis' the chapter seeks to make explicit the narratives that serve to justify the development of biofuel. It then reviews the expression of these narratives both at 'the global' and 'the local' levels and comments upon the interactions between the two.

Ferguson (1992) and Escobar (1995) suggest that global narratives – particularly those that infuse science with development – are hegemonic, masking local realities. Their

analyses provide valuable insights into the interactions between knowledge, power and policy. However, they have also been critiqued for dismissing the agency that exists in localities (Keeley and Scoones 2003). To what extent has discourse around the National Mission on Biodiesel in India been instrumentally determined by global narratives? Is there any evidence that they have become (re)negotiated on the basis of local knowledge, interests and circumstances?

3.3. 'The Biofuel Solution' – But, what are the challenges?

A number of countries across the globe have bought into 'the biofuel solution', and they have put in place various incentive mechanisms to encourage the development of biofuel – either domestically or abroad. These include agricultural subsidies and price support mechanisms that encourage the production of biofuel feedstock; blending mandates, primarily for the promotion of liquid biofuels for transport; subsidies and support for biofuel infrastructure; tariffs to safeguard domestic agriculture and biofuel industries; tax exemptions to stimulate demand; as well as funding for research and development (FAO 2008).

As discussed in chapter 2, there are various categories of biofuel. Forestry, agricultural or fishery products, as well as municipal waste, may act as feedstock. The biofuel that is derived from these sources can be solid (such as fuel wood), liquid (such as bioethanol or biodiesel) or gaseous (such as biogas). Unprocessed feedstock (or 'primary biofuels') are often used as cooking fuel, heating or electricity generation in domestic or mainly small-scale industrial applications. Processed feedstock (or 'secondary biofuels'), in turn, tends to be used as transport fuel or in larger scale industrial processes (*ibid*.).

According to the International Energy Agency (2004; 2007) and the Global Energy Partnership (2007) (as cited in FAO 2008), it is liquid biofuels for transport that has experienced the strongest growth in recent years. The various blending mandates that have emerged in the past decade are testimony to the belief in 'liquid biofuel for transport' sectors. Figure 2 below summaries some of these:

COUNTRY	BLENDING MANDATE
Brazil	20-25% blending of ethanol with petrol (mandatory); minimum of 3% blending of biodiesel with diesel by 2008 and 5% by 2010.
Canada	5% renewable content in petrol by 2010 and 2% renewable content in diesel fuel by 2012.
China	15% renewable content in transport fuel by 2020.
France	5.75% renewable content in transport fuel by 2008; 7% by 2010; 10% by 2015 (voluntary); 10% by 2020 (mandatory; based on the target of the European Union).
Germany	6.75% renewable content in transport fuel by 2010; 8 % by 2015; 10% by 2020 (mandatory; based on the target of the European Union)
India	Planned 5–10% blending mandate for ethanol with petrol; 20% for biodiesel with diesel fuel by 2020 (the target expressed in the National Mission on Biodiesel).
Italy	5.75% renewable content in transport fuel by 2010 (mandatory); 10 by 2020 (mandatory; based on the target of the European Union)
South Africa	8% renewable content in transport fuel by 2006 (voluntary); 10% target is under consideration.

United Kingdom	5% renewable content in transport fuel by 2010 (mandatory); 10% by 2020 (mandatory; based on the target of the European Union).
United States of America	9 bn gallons renewable content in transport fuel by 2008; 36 bn by 2022 (mandatory); of these, 21 bn are expected to be derived from advanced biofuels (of which 16 bn from cellulosic biofuels).
European Union	10% renewable content in transport fuel by 2020 (mandatory; proposed by European Union Commission in January 2008)

FIGURE 2 EXAMPLES OF FUEL BLENDING MANDATES [10]

Brazil is often hailed as a pioneer in the use of liquid biofuel for transport. In Brazil, ethanol has been used as a petrol additive since the 1920s, but it was in 1931 that a formal programme of blending sugar cane-derived ethanol with petrol began (FAO 2008). Following the first oil crisis in 1975, the Brazilian government built upon this initiative and established the National Ethanol Programme (ProAlcool). ProAlcool sought to reduce energy imports and make Brazil energy secure by supporting the domestic the sugar and ethanol sectors, along with the production of both anhydrous ethanol (that could be blended with petrol) and hydrated ethanol (that could be used as a fuel in its own right), and by encouraging the development of vehicles that could be fuelled by pure ethanol.

The second oil crisis in 1979 brought in its wake a larger scale bioethanol effort. Various financial incentives ensured the success of this push, but as oil prices receded

[10] After table 4, FAO (2008); figures as per early 2008.

and sugar prices increased, the programme appeared to flounder. Between 1989 and 2000, the Brazilian government set about deregulating its entire fuel supply system and the private sector became the driving force behind the industry. The use of pure or hydrated ethanol as a transport fuel decreased considerably, but a 1993 mandate to blend anhydrous ethanol with petrol brought about some recovery for sugar and ethanol production. In 2002, ethanol prices were liberalised, and the sugar and ethanol industries began increasingly to react to global market signals. Domestic demand for bioethanol has since been boosted through the widespread introduction of 'flex-fuel' vehicles that run on a petrol-ethanol blend (*ibid*).

In contrast to bioethanol, the biodiesel sector in Brazil is still comparatively nascent. In 2005, a biodiesel law was passed, which called for 2% and 5% renewable content in diesel fuel by 2008 and 2010, respectively. The law also provided for the establishment of tax incentives to support the production of feedstock on small-farms in the north and northeast of Brazil. Thus, in addition to the earlier energy security imperative, Brazil's efforts to develop biofuel were now also directed by explicit rural development and social inclusion concerns. In the years since ProAlcool, environmental questions had also emerged on the global political agenda. Accordingly, the rationales for developing biofuel in Brazil have come to include the goal of environmental sustainability (*ibid*).

In the United States, in turn, efforts to encourage the emergence of 'liquid biofuel for transport' industries are comparatively nascent. The policy scaffolds of biofuel development were laid down by the 1978 Energy Tax Act, which provided extensive tax exemptions for alcohol fuel blends. More recent steps to encourage an enabling environment for biofuel production include the 2000 Biomass Research and Development Act; the 2002 Farm Bill; the 2004 American Jobs Creation Act; the 2005

Energy Policy Act; and the 2007 Energy Independence and Security Act. Collectively, these form a policy framework that in 2007 supported and sponsored the production of 30 billion litres of bioethanol from maize and 2 billion litres of biodiesel from soybean. Additionally, the United States have made significant investments into the production of biofuel from 'next-generation', cellulosic feedstock. Similar to Brazil, the United States has justified its biofuel development efforts as means of advancing its energy security, boosting rural employment and contributing towards environmental sustainability (*ibid*.).

The European Union, in contrast, has placed greater emphasis on the development of biodiesel from rapeseed, sunflower oil and soybean oil. Sugar beet and cereals act as feedstock for bioethanol production. In 2007, the European Union produced 6 billion litres of biodiesel, and 3 billion litres of bioethanol. The biofuel policy environment in the European Union includes three European Union Directives. The first of these (Directive 2003/30/EC) is a mechanism for encouraging a biofuel market within the European Union by setting out 'reference' blending requirements for member countries. The second (Directive 2003/96/EC) provides tax incentives for biofuel production and use. The third (Directive 2003/17/EC) establishes the environmental specifications of biofuel. The reforms of the Common Agricultural Policy, as well as the European Union's latest rural development policy, further stimulate the development of biofuel within the European Union by encouraging farmers to diversify into biofuel feedstock. The 2007 'An Energy Policy for Europe' communication from the European Commission sets out a mandatory 10% renewable content in transport fuel by 2020 (*ibid*.).

According to studies by the Food and Agriculture Organisation (as cited in FAO 2008), the most commonly expressed rationales behind biofuel policies include the belief in the ability of biofuel to address high and volatile petroleum prices; to act as a substitute for fossil fuels and thereby mitigate global climate change; and to promote economic revitalisation in rural areas. These are exemplified in the European Union's "Strategy for Biofuel" paper, which also indicates the potential of international trade to benefit biofuel-producing developing countries (Commission of the European Communities 2006):

> *"The EU is supporting biofuels with the objectives of reducing greenhouse gas emissions, boosting the decarbonisation of transport fuels, diversifying fuel supply sources and developing long-term replacements for fossil oil. The development of biofuel production is expected to offer new opportunities to diversify income and employment in rural areas"* (p. 3).
>
> *"Biomass productivity is highest in tropical environments and the production costs of biofuels, notably ethanol, are comparatively low in a number of developing countries"* (p. 6).
>
> *"The production of biofuels could provide an opportunity to diversify agricultural activity, reduce dependence on fossil fuels (mainly oil) and contribute to economic growth in a sustainable manner"* (*ibid.*; p. 6-7).

Indeed, these rationales are also embedded within the National Mission on Biodiesel:

> *"The capacity of Jatropha curcas to rehabilitate degraded or dry lands, from which the poor mostly derive their sustenance, by improving their water retention capacity, makes it an instrument for up-gradation of land resources and especially for helping the poor. Thus, grown on a significant scale, Jatropha can clean the air and green the country, add to the capital stock of the farmers and the community and promote crop diversification which is imperative in Indian agriculture. The chain of activities from raising nurseries, planting, maintaining, primary processing and oil extraction is labour intensive and will generate employment opportunities on a large scale, particularly for the rural landless and help them to escape poverty"* (Planning Commission of India 2003; p. iv)

Biofuel as a policy solution did not surface at random in a socio-political vacuum. Rather, its reasoning stems from a set of widely-held assumptions around securing energy supplies, advancing rural development, promoting environmental sustainability, mitigating climate change, and enhancing international trade. The subsequent sections review biofuel policy discourse as a product of three key narratives. As Keeley and Scoones (2003) suggest, the flow-of-logic of these narratives may be sound; however, if their initial premises are flawed, the subsequent "courses of action, plans, programmes and policies" will be inappropriate. Indeed, a review of the key narratives informing biofuel policy reveals them to be contested. Section 3.5 explores the implications of this contention for the technology-society relationship.

3.4. Key Narratives in Biofuel Policy Discourse

This section builds on an analysis of empirical material collected from a range of reports on biofuel (see footnote 9). It synthesises the widely-held expectations of biofuel, particularly as they pertain to developing countries. These fall into several categories. This analysis classifies them in terms of agriculture and rural development; climate change and the environment; and trade.

3.4.1. Agriculture and rural development

A core narrative in biofuel policy discourse revolves around the ability of biofuel to promote rural development. The narrative proceeds as follows: The agricultural sector in developing countries is facing a crisis (for instance, Hazell and Pachauri 2006). Despite recent increases in the price of food, long-term agricultural commodity prices have declined as supply has outpaced demand. As a consequence, agriculture is becoming an unreliable source of livelihood (Hazell and Pachauri 2006).

Simultaneously, returns per hectare have begun to decline and smallholdings are being consolidated. This has resulted in migration from rural to urban areas, as farmers set out to find alternative income sources.

The cultivation, harvesting and processing of feedstock for biofuels is said to offer a means of reinvigorating the recessive agricultural sectors in developing regions. Since agriculture in developing countries tends to be labour intensive (Hazell and Pachauri 2006; De La Torre Ugarte 2006), demand for new agricultural commodities – such as biofuel feedstock – is seen as offering new employment opportunities and improved incomes. If this income is spent within the community, it will boost other sectors of the local economy. In addition, biomass feedstock tends to be bulky and heavy, making its transport in raw form costly and carbon intensive. This implies the need to establish procurement and processing facilities in the vicinity of feedstock supply. The actual construction and operation of these facilities will lead to further economic opportunities in rural areas. Organizing small-scale feedstock producers into farmer cooperatives that can link with large biofuel-processing firms can, in turn, enhance local-level benefits. These envisioned local benefits of biofuel sectors are ultimately thought to ease rural-to-urban migration by creating favourable economic environments in rural areas and fostering investment in local infrastructure, health and education (*ibid*.).

However, the assertions that biofuel will contribute towards rural development are in sharp contrast to counterclaims that it will lead to food and feed trade-offs as a result of the diversion of agricultural resources to energy production (for instance, James, et al. 2008; Josserand 2008; Rahman, et al. 2008). This is particularly the case with the current generation of liquid biofuel, which is largely derived from food crops. Although

some crops – such as *Jatropha curcas* – are non-edible and grow on less fertile lands, commercial production of biofuels may expand into high-quality areas as producers seek higher profit margins. This would push food crops to lower quality lands, thereby compromising food production. Although further increases in food prices would likely benefit well-off farmers, the scenario would disadvantage the rural and urban poor, who tend to be landless net food purchasers. Indeed, according to UN-Energy (2007), the "transition to liquid biofuels can be especially harmful to farmers who do not own their own land, and to the rural and urban poor who are net buyers of food, as they could suffer from even greater pressure on already limited financial resources" (p. 24).

3.4.2. CLIMATE CHANGE AND THE ENVIRONMENT

Rural development through the cultivation, collection and processing of energy crops is not the only benefit that biofuel development might offer. It also paves the way for carbon trading, which represents a further possible income stream for rural communities. The carbon trading potential of biofuel hinges upon its proclaimed ability to mitigate the impacts of climate change and environmental degradation. Biofuel feedstock sequesters carbon from the atmosphere during the course of its natural life cycle and, as such, offers a sink that accumulates greenhouse gases (GHG) from the atmosphere (Kartha 2006). Its other envisioned environmental benefits include new habitats for local species and the revitalisation of degraded or marginal lands. Biofuel may also serve to phase out traditional bioenergy (mainly fuel wood), which tends to deplete natural resources (UN-Energy 2007).

The Clean Development Mechanism (CDM), which was set out in the 1997 Kyoto Protocol, is the main framework for regulating carbon trading between developed and developing countries. Under the CDM, developed countries can invest in initiatives in

developing countries, which reduce GHG emissions, as a way of meeting their carbon reduction targets. This is thought to be an attractive alternative to what would often be more expensive emission reductions in developed countries themselves. The carbon credits granted under the CDM are intended to provide a further incentive to emission reductions; that is, credits are not allocated for already planned reductions.

A developed country acts as an applicant, seeking CDM approval for a project in a host, developing country. The applicant must demonstrate the benefits of the project by establishing a baseline estimation of the emissions, which would take place if the project were not approved. The application is then validated by a third party and either approved or rejected by the Executive Board of the CDM. Once a project is approved, the Executive Board grants Certified Emission Reductions (or 'carbon credits') to the project according to the difference between baseline and actual emissions (UNFCCC-CDM website). Thus, the development of biofuel initiatives under the CDM is said to enable farmers in developing countries to generate income. They may earn carbon credits through the cultivation or harvesting of energy feedstock and through trade of the resulting credits with carbon emitting actors elsewhere.

Again, however, these assertions are far from unchallenged. While biofuel may have the potential to mitigate the impacts of climate change and environmental degradation, some cultivation methods may be highly carbon intensive, thereby negating any carbon reductions that might come from the displacement of fossil fuel. The use of fertilisers and pesticides; the transport and processing of feedstock; and the refinement and distribution of the final product could potentially skew the so-called 'zero- or low-carbon profile' of biofuel. Moreover, bringing otherwise unused land under energy crop cultivation or harvesting agricultural waste that would otherwise maintain soil fertility

may increase the rate of soil erosion, thereby intensifying environmental degradation. The large plantations of energy crops that are being planned in some countries are said to potentially reduce biodiversity by displacing, as opposed to creating, habitats (Kartha 2006). As an agricultural activity, the cultivation of biofuel feedstock may contribute towards the depletion of natural resources – including water – which are already scarce in a number of regions (De Fraiture, et al. 2008).

Moreover, the CDM itself has not escaped controversy. The eligibility of biofuel for carbon trading is determined by life-cycle analyses. These provide the greenhouse gas balances of biofuels relative to equivalent energy amounts of fossil fuels (FAO 2008). Whether biofuels 'make environmental sense' depends on the trade-offs between the greenhouse gas savings and the emissions that arise during their production and use. The results of life-cycle analyses vary markedly between types of feedstock, production methods, conversion techniques and end-use. The outcomes of life-cycle analyses also differ according to the evaluation methodologies that are used. At the moment, there is no standard procedure for assessing the greenhouse gas balances of biofuels, nor their broader environmental or social impacts. Some methodologies may, for instance, omit assessing the carbon impacts of diverting land to the production of biofuels. Yet, the FAO (2008) notes that land-use changes are particularly impactful in lifecycle analyses – they may lead to greenhouse gas emissions that are higher for biofuel production systems than those of their fossil fuel equivalents.

Early experiences with implementing the CDM have brought to light its various shortcomings. Firstly, the eligibility criteria of projects has generated debate (Forsyth 2007). The acceptability of so-called 'sink' projects – initiatives that set aside land or forest to sequester atmospheric carbon – has been a particular point of contention.

Some countries have supported such projects by virtue of their cost-effectiveness. Others, India among them, have argued that such projects fail to create long-term capacity to deal with climate change mitigation. They are said to remove an incentive for industrialised countries to tackle their greenhouse gas emissions. Further, opponents question the effectiveness of sinks to sequester carbon (Cullet and Kameri-Mbote 1998; as cited in Forsyth 2007). Others have argued that sink projects represent a form of colonialism by preventing agricultural expansion in order to support emissions reductions in developed countries (Forsyth 2007).

Secondly, the CDM process has been criticised for being too complex, and for offering only limited returns on investments. As a result, relatively few CDM projects have attracted the interest of investors (Cosbey, et al. 2005). Moreover, CDM projects are subject to deliberations by the CDM Executive Board, by national authorities and by concerned stakeholders. Investors have been deterred by the complexity and, at times, contradictory nature of these deliberations.

Finally, countries that host CDM projects have noted that although some projects may have contributed towards a reduction in greenhouse gas (GHG) emissions, they have done little to enhance – or in some cases, they have even contradicted – other sustainability and development imperatives (*ibid*.). The environmental policy community has responded by creating the concept of 'the development dividend', which seeks to enhance the quantity and quality of CDM projects. In particular, the development dividend calls for projects to go beyond seeking lower greenhouse gas emissions by also stimulating better air quality, improving electricity provision and increasing incomes and employment (Cosbey, et al. 2005). However, realising the development dividend has proved far from straightforward (Forsyth 2007). Investors

still tend to favour projects that aim at lower carbon emissions as opposed to the broader objective of sustainable development (IISD 2005; as cited in Forsyth 2007). The 2001 Marrakech Accords served to address some of these concerns. Among others, it granted hosts a right to determine, which CDM proposals qualified for CDM review along with the acceptable number of 'sink' initiatives (Forsyth 2007).

Nevertheless, various unresolved issues remain. Since its inception in 2005, the CDM has been dominated by projects that seek to reduce the greenhouse gas emissions that are generated during industrial energy use. Although these include bioenergy initiatives, biofuel projects – which mainly replace fossil fuels used in the transport sector – have not been a fail-safe means of earning carbon credits. Part of the problem appears to be the difficulty of devising the appropriate methodologies for assessing biofuel proposals. This will ultimately define the carbon trading potential and development benefits of biofuels.

3.4.3. TRADE

A further narrative in biofuel policy discourse revolves around international trade. As oil prices have risen and as the Kyoto Protocol has come into force, the search for alternative cost-effective and environmentally-friendly fuels has taken on a new urgency. Biofuel substitution targets have emerged in countries across the globe as testimony to the belief in biologically-sourced energy is an economically feasible and environmentally friendly alternative. However, those regions with potentially highest demand for biofuel – including the United States, the European Union and Japan – are thought to have a limited capacity to produce their target quantities (Dufey 2006). As a result they are likely to have to import raw or semi-processed feedstock or fully manufactured biofuel, thereby paving the way for its international trade. The

Netherlands, for instance, estimates that it will need to import 80% of the necessary feedstock to meet its fuel replacement targets, due to a lack of sufficient arable land (GAIN Report 2005; as cited in Dufey 2007).

Conversely, many developing regions are seen as well-suited for the production of biofuel feedstock and biofuel itself. Indonesia and Malaysia are among the key palm oil producing countries and they are expected to supply part of EU demand (Dufey 2007). Ecuador and Colombia are also expanding the production of palm oil as biofuel feedstock, while Argentina and the Philippines are focusing on coconut oil. Various African and Asian countries are looking towards cultivating energy crops, such as *Jatropha curcas*. As mentioned earlier, Brazil is producing both soy and sugar as biofuel feedstock. Other sugar-producing countries – including Guatemala, El Salvador, Pakistan, South Africa and Swaziland – are also indicating their interest in trading sugar as a biofuel feedstock. The manufacture and international trade of biofuel are said to stimulate the macro-economic growth of developing countries.

However, this narrative too has been challenged. Although biofuel is touted as a means of promoting international trade, existing trade regimes are unable to provide clear guidelines as to how biofuel trade should be governed. There are suggestions that under current systems, biofuel-producing developing countries are likely to be disadvantaged (Dufey 2006). The World Trade Organisation (WTO) sets out and governs the main frameworks for international trade. Under existing rules, there is no definitive classificatory mechanism for biofuel; instead, biofuel can be traded as an industrial, agricultural or environmental good. Each type of good is subject to a specific set of trade rules. Trade in agricultural goods – such as raw biofuel feedstock – is guided by the Agreement on Agriculture. Trade in oil and ethanol – semi-processed

biofuel – is governed by the General Agreement on Tariffs and Trade (GATT), which pertain to industrial goods. The recent Doha Round of trade talks considered formalising trade in 'environmental goods', which would encompass biofuel. Indeed, Dufey (2006) argues that trading biofuel as an environmental good is likely to offer the greatest benefits for developing countries.

Further complication is added by the fact that despite the apparently strong incentive for trade in biofuel, a number of developed countries continue to support their domestic biofuel industries through various mechanisms, including subsidies. Other means include tariff barriers, which impose extra costs on the import of fuel and feedstock. Tariff escalation systems, in turn, favour the import of unprocessed feedstock to developed countries. This implies that actual biofuel conversion processes – and value-addition stages – take place in importing markets (Dufey 2006).

In addition, importing markets may set various technical, environmental and other standards for traded goods. These non-tariff barriers include a system of 'green certificates', which the European Union is proposing under its Biomass Action Plan in order to assess the sustainability of imported biofuel feedstock and biofuel. Such regulations may limit the types of biofuel imports that are allowed to enter EU markets. Sanitary and phytosanitary regulations that apply to plant pests and diseases are likely to also pertain to energy crops. The application of biotechnology to the development of energy crops would also extend technical regulations on traceability and labelling of genetically modified organisms (GMOs) to energy crops as well (Dufey 2006). At the moment, there is a lack of harmonised regulatory systems. Consequently, biofuel producing developing countries need to cater to different standards, thereby raising

the costs of biofuel production. It also remains unclear, who will incur the costs of implementing the regulations.

Indeed, the extent to which export-oriented agricultural production benefits small-scale primary producers is unclear. Analyses of agricultural commodity markets suggest that upstream actors in value chains often reap the greatest returns. Moreover, agricultural commodity markets are controlled by a small number of multinational agro-chemical companies – in the case of grain, for instance, two companies (Cargill and Archer Daniels Midland) command 65% of the market. Against this current backdrop, export-oriented biofuel value chains are unlikely to provide benefits to small-scale farmers (*ibid*.).

3.5. VISION OF TECHNOLOGY-SOCIETY INTERACTIONS

3.5.1. TECHNOLOGICAL DETERMINISM

This section builds on its predecessor by exploring the vision of technology-society interactions that are embedded in biofuel policy discourse. This discourse readily gives the impression of technological certainty and instrumentality. It suggests that biofuel technology can be drawn upon to generate carefully-defined societal outcomes. The technology itself appears as a though guided by an inner force, immune to the influences of social externalities.

These understandings of technology and its relationship to society are crystallised in notions of 'technological autonomy' and 'technological determinism'. The former implies an internally-directed process of technological change, while the latter refers to the ability of technology to determine the nature of societal change (Edgerton 1993; as cited in Winskel 2002). Although distinct theories – autonomy being an explanation of

technology, while determinism is a description of society – the two are often found to be closely intertwined (Winskel 2002).

How is technology said to have directed societal change? One example is provided by the paradigm of 'development as modernisation'. The paradigm traces its roots to the rise of industrial capitalism in late 18th century Europe (for instance, Edelman and Haugerud 2004). The industrial revolution cemented the view that capital investments and productive forces can lead to material gains (Clark 1985). The extent of these material gains, in turn, became an indicator of social advancement. The industrial revolution prompted suggestions that societies evolved according to stage-wise advancement – or teleological histories. They underwent transitions "from kinship to contract, agriculture to industry, personalised to rational or bureaucratic rule, subsistence to capital accumulation and mass consumption, tradition to modernity and poverty to wealth" (Edelman and Haugerud 2004; p. 2).

It was during the industrial revolution that technology became seen as one of the crucial motors of economic productivity. Prior to the industrial revolution, technology and technological change was largely exogenous to prevailing economic systems, such as the slave economy or feudalism (Clark 1985). The industrial revolution reframed the relationship between technology and economic order. The division of labour and the specialisation of functions that were integral to the industrial revolution, "paved the way for the systematic application of scientific knowledge to the productive process" (*ibid.*; p. 32). 'Development' and 'modernisation' became synonymous with 'technological advancement'.

Equated with Rostow (1960), 'modernisation' builds on ideas of teleological histories and takes as its starting point the evolutionist assumption that social progress occurs according to a linear and universal sequence. 'Underdevelopment', thus, becomes a question of the stage at which particular societies find themselves. Wealthy and industrial societies are taken as the norm of 'development'. Defined against this standard, Clark (1985) outlines how less developed countries are, in contrast, thought of as "*backward* in terms of their cultures, political systems, social institutions and economic resources" (p. 167; emphasis in original). According to the modernisation paradigm, "the objective of [less developing countries] should be to compress … [the modernisation] process into the shortest possible time-scale" (Clark 1985; p. 165) by borrowing, buying or copying those aspects of developed countries, which are believed to have been instrumental in bringing about economic growth. In other words, the modernisation paradigm encourages developing countries to build on the experiences of developed countries in order to circumvent some of the stages that they have gone through – a process known as 'leapfrogging'.

Few issues exemplify this as succinctly as the patterns of industrialisation adopted by rapidly emerging economies, such as China and India. The concern is that were these countries to follow 'the conventional development path' paved by the industrialised world, the current natural resource base would be subjected to unprecedented pressures and collapse (for instance, Flavin and Gardner 2006). As in the case of 'the development challenge', 'the environmental sustainability challenge' is also believed to be responsive to technology. Technological innovation is argued to offer a means through which developing countries can circumvent the environmentally damaging effects of industrialisation. In fact, ecological modernisation suggests that economic growth and environmental well-being need not be mutually exclusive. On the contrary

– continued technological development and industrialisation hold the keys to unlocking contemporary environmental crises.

Thus, biofuel policy discourse – in its definition of societal challenges and its approach towards addressing them – appears to be an extension of the modernisation paradigm and its associated technological determinism. At first glance, biofuel seems an uncontested means of prompting societal change towards predefined ends. Within the context of development, it is a means of propelling countries along a trajectory of industrialisation: intensifying agricultural production, and in the process, 'lifting' sizable communities out of agriculture; enabling a shift from subsistence to capital accumulation, and mass production and consumption; and ultimately, a transition from poverty to wealth.

However, biofuel policy discourse goes beyond the conventional paradigm of modernisation. In evoking the 'environmental challenge', it acknowledges the negative environmental impacts of the path of industrial development that so-called advanced countries have followed. Yet, its response is not to question the premises of the paradigm. Instead, science and technology remain the appropriate tools with which to address the unintended consequences of economic development.

3.5.2. SOCIETY-SHAPING AND SOCIALLY-SHAPED TECHNOLOGY

Section 3.4 alluded to the contested nature of biofuel by outlining a series of narratives and counter-narratives that have become negotiated into apparently stable biofuel policy discourse. What does this contention imply for understandings of technology and its relationship to society more broadly? Where do they leave the 'technological

determinism and autonomy' and 'development as modernisation', which were described above?

Science and Technology Studies (STS) offer an alternative account of technology-society interactions, which is able to account for such contention. STS research has challenged the perception of science as a direct reflection of nature – and technology as a simple extension of that knowledge. In the process, they have questioned the definiteness of scientific knowledge and the instrumental ability of technological artefacts or projects to prompt societal change.

The point of departure for contemporary STS is the heterogeneous nature of science and technology. In the case of technology, STS assumes from the outset that the category consists of diverse components from the realms of the social, economic, scientific, historical, cultural and political – not just the technical. Among the issues that STS has sought to understand has been the interweaving of 'the scientific' and 'the technical'. Since Francis Bacon and René Descartes in the early 17th century, technology had conventionally been thought of as 'applied science' (Sismondo 2004). However, contemporary STS scholars have questioned whether scientific knowledge is a necessary precursor to the development of technologies. Rather, they argue that a system of 'technological knowledge' appears to exist alongside its 'scientific' counterpart (for instance, Layton 1971, 1974; Laudan 1984; as cited in Sismondo 2004). Others maintain that the categories of 'science' and 'technology' are themselves too obscure for any definite relationship to exist between them (for instance, Hughes 1987). The concept of 'technoscience', which stems from Actor-Network Theory (ANT) (Latour 1987), captures the blurry borders and growing convergence between the two.

Even 'technoscience' is more than the sum of 'the scientific' and 'the technical'. Rather, it also assembles political, financial, social, material and rhetorical resources. Literature on Large Socio-Technical Systems (LSTS) (Hughes 1983), the Social Construction of Technology (SCOT) (Pinch & Bijker 1984) and Actor-Network Theory (ANT) (Law 1987) has highlighted the bringing together of these resources by system builders (Hughes 1983; 1987) and heterogeneous engineers (Law 1987). These three theoretical perspectives are united in their interest in the diversity of elements that go into what is conventionally seen as 'technology', as well as the interconnections between them. In particular, they challenge any neat classifications of 'the technical' and 'the other': "Technology/society, pure/applied, internal/external, and technical/social are some of the dichotomies" (Bijker, Hughes and Pinch 1987; p. 10) that inventors, engineers, and managers have dispelled through their system- and network-building.

Indeed, ANT suggests that for dominant narratives to become incorporated into policy discourse, networks of actors or coalitions of stakeholders must be constructed and maintained (Latour 1987). These networks or coalitions collectively compose and diffuse 'black-boxed' narratives (which draw from seemingly uncontested facts, theories and evidence) in efforts to enrol others into their endeavours. All of the actors in a particular network must buy into the narratives for the technoscientific initiative to succeed. Narratives gain currency and diffuse through networks of development practitioners (Roe 1995; Leach and Mearns 1996). As suggested earlier, dominant narratives become programmatic, forming the basis of 'blueprints' or a standard set of procedures for addressing policy challenges. In so doing, narratives act to narrow the space that is available to pursue alternatives (Keeley 1997; as cited in Sutton 1999).

In the case of the National Mission on Biodiesel, the Committee on the Development of Biofuel identified the stakeholders who would be involved in order for the initiative to be successful. This 'formal' network of actors is shown in figure 3 below (Planning Commission of India 2003). They include government ministries and departments, national research organisations, non-governmental organisations and private enterprises from various sectors of the economy.

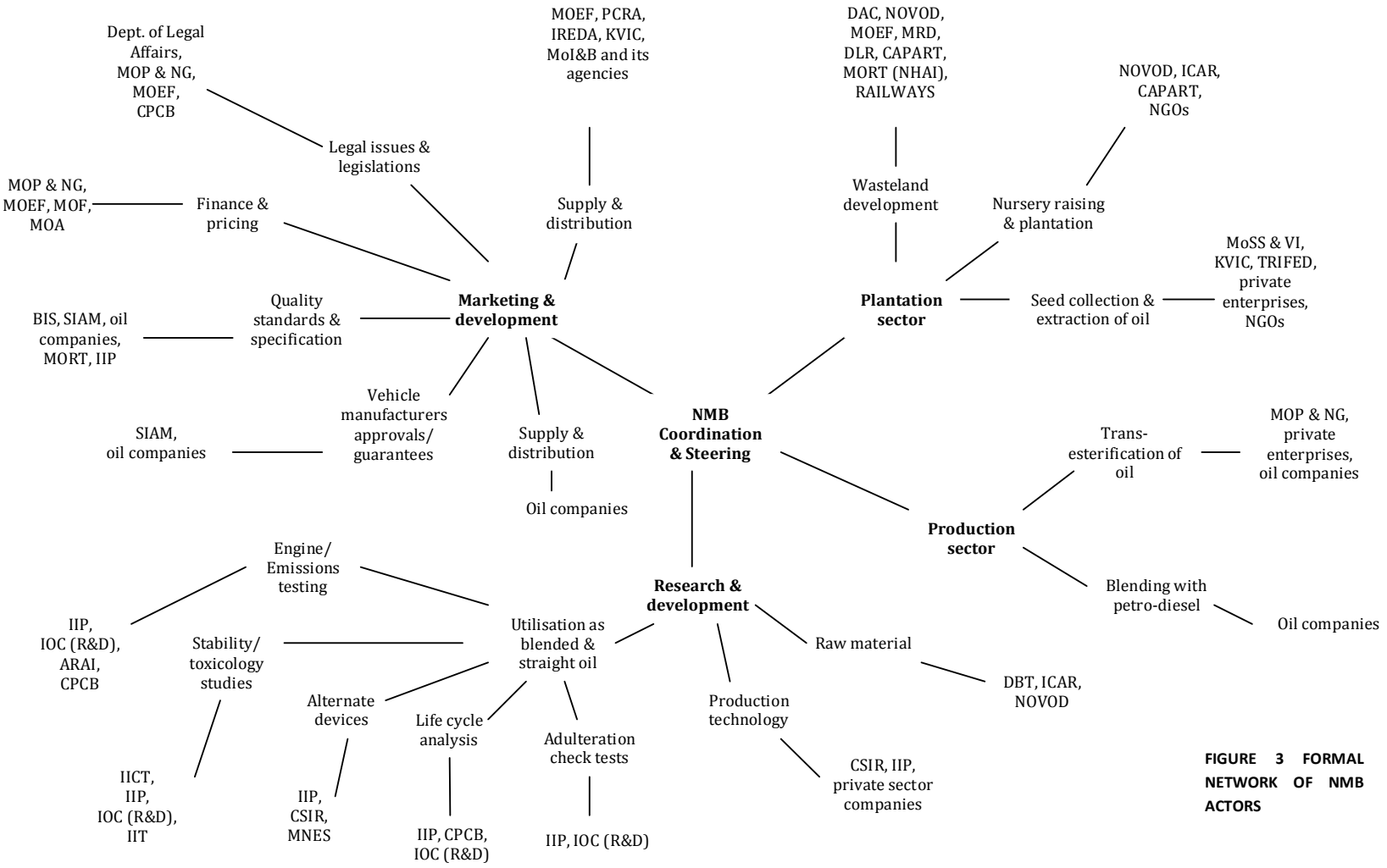

FIGURE 3 FORMAL NETWORK OF NMB ACTORS

SCOT, ANT and LSTS all provide the vocabulary for understanding 'science-as-practice' as opposed to 'science-as-knowledge', thereby shifting the analytical lens from 'product' to 'process'. They provide a means of following system builders and heterogeneous engineers as they "construct or force unity from diversity, centralisation in the face of pluralism, and coherence from chaos" (Hughes 1987; p. 52). System-builders bring together a range of entities – "from people, through skills, to artefacts and natural phenomena" (Law 1987; p. 129) – into stable systems and networks. That is, science and technology come to be seen *socially shaped*.

These frameworks have not escaped critical scrutiny. For instance, their emphasis on 'system builders' and 'heterogeneous engineers' has led to analytical accounts that concentrate on a few key figures. Such analyses have been argued to overlook other implicated actors, particularly those in the margins (for instance, Casper and Clark 1998; Star 1991). Chapters 4 and 5 expand on this point further.

Research on technological systems and actor-networks suggests that technoscience comes to embody scripts (Akrich 1992) of the social, political, economic and cultural circumstances of its intended setting. In other words, statements on the societal impacts of technology are based on particular sketches of the social order that they intend to generate. However, when technoscientific scripts are 'unleashed', a disparity may arise between the intended and the actual. Akrich (1992) draws on examples of technology transfer from developed to developing countries to illustrate how technoscientific objects and their intended settings may be mismatched. Under such circumstances, the flexibility or obduracy of technoscience and its environment determines the eventual success or failure of the project. These insights suggest that

science and technology are *society-shaping*, but not necessarily in the anticipated manner.

Such postulations provide an alternative to the technological determinism embedded in global biofuel policy discourse. When viewed as a socio-technical construct, biofuel is seen to evoke particular scripts or narratives that bind together "elements of the technical, the social, the economic, and so on" (Akrich 1992; p. 206). The likelihood of scientific and technological projects producing their exact, intended societal outcomes – and only these – hinge upon a direct correlation between scripts or narratives and 'lived experiences' on the ground. However, past research in both STS and development studies suggests that this is rarely the case. In predicting the societal impacts of science and technology – particularly within the context of development – it would appear reasonable to 'expect the unexpected'.

Having examined biofuel policy discourse and its underlying narratives on a global scale, and interrogating the technology-society relationship implied by it, the subsequent section will explore the debate around and assumptions embedded within the National Mission on Biodiesel in India. It builds on the introduction to the research topic that was presented in chapter 2. Ultimately, the section seeks to comment upon the interactions between 'the global' and 'the local' in large-scale technological projects.

3.6. The Biofuel Landscape of India

The discussion so far has suggested that biofuel policy discourse tends to frame biofuel technology as instrumental and deterministic. Indian efforts to develop biofuel through the National Mission on Biodiesel are no different. Reflecting global justifications for the development of biofuel, this initiative also seeks to prompt energy security (the

reduction of dependence on costly foreign oil imports), environmental sustainability (the reduction of greenhouse gas emissions, particularly from transport infrastructure and the regeneration of marginalised lands), economic growth (sustaining current levels through a reduction in oil imports and generating new business opportunities around biofuel production) and rural development (the diversification of agricultural production) through an expansive technological technology-led endeavour.

Despite such parallels between 'the global' and 'the local', the narratives underlying biofuel discourse in India – particularly those around the National Mission on Biodiesel – exhibit distinct features that reflect the unique circumstances of the country. As the subsequent sections will reveal, these narratives have not escaped criticisms. Yet, they have become sufficiently stabilised for them to have been incorporated into the National Mission on Biodiesel. Chapter 4 explores in more detail the processes through which this stabilisation has occurred.

The policy discourse around the National Mission on Biodiesel was summarised by a number of interviewees as centring on so-called 'pro-poor' and 'pro-growth' scenarios – that is, means of producing biofuel that benefit marginalised communities and that continue to drive macroeconomic growth. According to interviewees, a 'pro-poor' scenario would allow for the production of straight vegetable oil (SVO) at a local-level from appropriate feedstock to secure access to energy – either as fuel for motive power or in generating electricity for local-level grids – in remote rural areas. A 'pro-growth' scenario, on the other hand, would place greater emphasis on the cultivation of energy crops in plantations in order to produce vast volumes of biodiesel for large-scale industrial or transport uses.

Despite these being the 'stories' that were sold by the National Mission on Biodiesel, interviewees noted that they were built on a number of uncertainties – particularly around the rural development potential of a biofuel scheme that had a marked private sector presence; the status of the lands that the Mission had identified as suitable for the cultivation of *Jatropha*; along with the positioning of renewable energy initiatives, such as the National Mission on Biodiesel, within India's broader energy strategy. The subsequent sections chart some of these contested narratives and the means through which the National Mission on Biodiesel sought to reconcile them.

As a brief reminder, the National Mission on Biodiesel planned to achieve its stated goals through the cultivation of *Jatropha* on so-called wastelands, which are thought to be of limited economic or ecological benefit. *Jatropha* was selected as the crop-of-choice because of its proclaimed ability to thrive in areas of low rainfall and alkaline soils – conditions that are said to characterise wastelands. While the financial resources for the implementation of the National Mission on Biodiesel initially came from the government, its continuation was dependent upon investments from the private sector and other stakeholders.

3.6.1. Addressing agrarian distress

Among the narratives that informed the National Mission on Biodiesel was the rural development problematic. In line with the paradigm of 'development as modernisation', successive Indian governments have attempted to 'move the country out of agriculture' (Gupta 1998). Despite these efforts, agriculture continues to employ over half of the country's workforce, although the sector contributes less than 20% to India's Gross Domestic Product (Planning Commission 2008). India has seen impressive economic growth rates in the past few years – figures for 2006-2007

suggested 8.4% aggregate growth across the economy (World Bank 2008b). However, the agricultural sector has yet to exhibit similar figures.

The term 'agrarian distress' has become shorthand for the perilous condition in which many Indian farmers find themselves (for instance, Suri 2006). The National Agricultural Policy of India has acknowledged that:

> *"[A]griculture has become a relatively unrewarding profession due to a generally unfavourable price regime and low value addition, causing [the] abandoning of farming and increasing migration from rural areas. The situation is likely to be exacerbated further in the wake of integration of agricultural trade in the global system"* (Ministry of Agriculture 2000; as cited in Suri 2006; p. 1523).

Farmers are increasingly indebted as a result of agricultural expenses. Inequality between rural and urban households, and between cultivators and non-cultivators, is increasing. As a result, families are disintegrating and agricultural practices are becoming increasingly individualised. A recent and dramatic rise in farmer suicides is often cited as evidence of the severity of this crisis (Commission on Farmers' Welfare 2005; as cited in Suri 2006). Among the solutions that have been proposed is the diversification of agricultural output into cash crops such as fruits, spices and – in the case of the NMB – biofuel. Yet, as section 3.4.1 suggested, the rural development impacts of biofuel are far from definite.

3.6.2. THE BENEFITS OF BIOFUEL BUSINESS FOR SMALL-SCALE FARMERS

A further narrative underlying the National Mission on Biodiesel is the assumption that private sector involvement in the nascent biofuel sector will confer livelihoods benefits for particularly small-scale farmers.

There has been a proliferation of private companies in India – both multinational and local – that have begun to show interest in the commercial development of biodiesel. A number of these firms pursue a strategy that was referred to by interviewees as 'the closed-loop mechanism'. According to this approach, companies procure feedstock from farmers on a contractual basis and then build processing facilities in the vicinity of feedstock sources in order to process the raw material. Firms, therefore, are said to stimulate local economies by generating employment opportunities.

However, the benefits of contracting agricultural production are ambiguous. Singh (2002) examined the practice of contract farming in the Indian state of Punjab among tomato, potato and chilli growers. He found that the impacts varied according to firm (multinational or local) and farmer (large-scale landowners, smallholders or the landless) types. In the short term, contract farming increased incomes and improved opportunities for wage labour. Yet, the arrangement also carried risks, some of which could only be detected in the long-term.

For instance, contract farming did offer a means for women to gain income; but, they tended to receive lower wages than men despite being highly efficient in their jobs. 'Agribusiness normalisation', whereby firms offer lucrative promotional policies in order to recruit farmers into contractual relationships, is common practice under contract farming. However, it is rarely sustainable and firms soon dissolve contracts, retaining only those that are cost-effective from the firm's point of view. Contracts are often dissolved once farmers have made the initial investment into new crops and inputs, leaving those who are 'dropped' without a means of gaining returns on their investment. Furthermore, contract farming encourages repeated cultivation of specific crops, which makes the soils susceptible to degradation and infestations and increases

the likelihood of crop pests and diseases. In the Punjab, Singh noted a lack of regulatory, advisory and oversight structures – such as cooperatives or non-governmental organisations – which could oversee the welfare of farmers under contracts.

In contrast to the contract farming scenario, the United Nations estimates that small-scale farmers would be more resilient to fluctuating agricultural commodity prices if they had more of a stake in bioenergy value chains, beyond supplying feedstock (UN-Energy 2007).

3.6.3. Institutional arrangements

Indeed, the production and use of biofuels lends itself to a variety of scales, ranging from "small-scale production for local use…with excess for sale [to] smallholder production of feedstock that is processed in a central conversion facility [to] feedstock purchasing from small-to-medium sized producers with concentrated ownership of processing and distribution [up to] concentrated ownership of the entire production chain" (UN-Energy 2007; p. 28).

While not necessarily mutually exclusive, one report on biofuel in India argues that "a clear choice needs to be made on priorities of use of the [oil] produced from plants such as jatropha" (Srivastava 2006; p. 3). This is unsurprising given that the different scenarios imply particular institutional arrangements between the public and private sectors, which in turn, contribute towards determining those who gain and those who lose from biofuel development. The public sector is said to have a role to play in any biofuel scenario that is pursued (Hazell 2006). Biofuels require substantial, up-front investments in order to set up production systems that yield biofuels that are

competitive with fossil fuels. Diverse stakeholders – including farmers, car manufacturers, fuel distributors and consumers – must coordinate their investments in order for a viable biofuel sector to emerge. In the absence of such coordinated efforts, the public sector must step in. The public sector has a role to play in providing subsidies for producers and consumers; in supporting the construction of relevant infrastructures; and in establishing market incentives, such as biofuel quotas (for instance, blending requirements) (*ibid*.).

Not all facets of biofuels can be assessed in purely market terms. Allowing the private sector to be the sole force shaping the development of biofuels may result in a form of production that will fail to generate non-market benefits. Hazell (2006) argues that the emphasis thusfar has been on setting up large-scale processing and production facilities for biofuels as these are considered the most cost-effective option for private firms. However, the financial and energy costs of moving bulky feedstock to centralized processing and production facilities suggests that there is scope for decentralized, smaller scale production of biofuels, which would be of more immediate benefit to rural communities. In other words, while biofuel development by large-scale producers is likely to generate higher financial profits, smaller-scale biofuel industries are believed to offer greater social returns (UN-Energy 2007).

Second generation biofuels – derived from non-edible parts of plants and non-food crops using advanced production techniques – are likely to require the development of capital intensive, complex processing facilities. Their construction is likely to be partly, if not wholly, a task for private companies. This would reinforce an emerging shift in the rural economy of many developing countries, whereby large, often multinational companies are beginning to acquire ownership of entire agricultural commodity value

chains. As a result, they are in a position to set the price of feedstock produced by independent suppliers. Under such arrangements, profits are unlikely to be determined by the production of feedstock; rather, they will arise from converting feedstock into bioenergy – a process termed 'value addition' – which is likely to shift benefits away from feedstock suppliers to feedstock processors (UN-Energy 2007).

Despite such discrepancies between the two scenarios, both are allowed for under the auspices of the National Mission on Biodiesel. Yet, as a number of interviewees indicated, the overall success of the initiative hinges on the ability of the National Mission on Biodiesel to effectively bridge these divergent narratives.

3.6.4. UNUSED WASTELANDS

As mentioned previously, the National Mission on Biodiesel plans to promote the cultivation of *Jatropha* on so-called wastelands. The 'wasteland' narrative informing the National Mission on Biodiesel maintains that such areas are of limited economic or ecological benefit.

However, this may not be the case. Wastelands tend to be common property resources – in other words, they are under the collective ownership of a group, such as a village. It is membership of such groups that confers right-of-access to the resources. Indeed, far from being unused, these lands convey a variety of livelihood options for users, including food, fuel, fodder, timber and building materials (Ravindranath and Hall 1995, Gundimeda 2005; as cited in Rajagopal 2008). A study by Gundimeda (2005) suggests that in the arid and semi-arid areas of India, common property resources (such as wastelands) provide 12-25% of the incomes of poor households. The poorer the household, the more crucial such resources become. Since it is the poor, rather than

the well-off, who tend to access common property resources, such resources contribute towards rural equity.

Converting these lands into biodiesel plantations may compromise the benefits currently incurred from them by poor and marginalised communities, and it is unclear whether alternative uses would convey similar advantages. *Jatropha* leaves, for example, cannot be used as fodder and *Jatropha* trees yield very low levels of wood that could be used as fuel.

Even if wastelands were to be converted into *Jatropha* plantations, variations in the oil content of *Jatropha* seeds would make the economic benefits of feedstock cultivation unpredictable. Moreover, the plant has been found to be affected by pests and diseases despite claims to the contrary. High yields, such as those envisioned in the National Mission on Biodiesel, demand high plant density. This cannot be sustained without good soil conditions and regular irrigation (Rajagopal 2008). Wastelands – and the communities that live off them – are not serviced by the type of infrastructure required to realise maximum yields.

3.6.5. Feeding India's energy appetite

Section 2.2 outlined the contemporary political economy of India. It mentioned a series of economic reforms that are credited with expanding the Indian economy at an unprecedented pace. Its rapid economic advancement appears to have made India 'energy-hungry' as it seeks to sustain its economic expansion. The International Energy Agency (IEA) (2007) estimates that India will become the world's third largest energy consumer (after the United States and China) by 2030 if it sustains the 8% annual economic growth rate and if its population continues to expand according to

predictions. India currently meets 75% of its oil needs through expensive imports. This proportion is expected to rise to above 90% by 2030. Natural gas, which is used for power generation and as transport fuel, is showing a similar trend.

India's dependence on foreign oil raises a number of threats, both to its energy security and economic prosperity. This dependence, combined with the country's mounting energy needs, has created a strong impetus for renewable energy in India (*ibid.*). Indeed, India has cast itself as "the world's next clean energy hot spot" (Ringwald 2008; p. 5). It is said to be the only country in the world with a separate ministry dedicated to new and renewable energy. The country is embarking upon the construction of the first multi-megawatt solar photovoltaic power plant, and its development of wind energy has received international accolades (*ibid*.).

As indicated earlier, renewable energy is said to offer a 'detour' through which developing countries can bypass the environmentally detrimental impacts of industrialisation. Pachauri (2004), for instance, notes that "a developing country like India cannot pursue the same path [of industrialisation as developed countries]...Blindly aping the consumerist approach of the developed world, and neglecting the ecological footprint of lifestyles, would prove disastrous" (p. 703). A sense of urgency is given by estimates that India is expected to experience one of the largest increases in greenhouse gas emissions in the upcoming decades. Moreover, its existing electricity infrastructure is uneven and risks leaving approximately 400 million people without access to reliable and safe sources of energy (*ibid*.).

Simultaneously, however, interviewees noted that a number of private sector companies planned to export biofuel to foreign markets because at the time of research Indian demand was "immature". This appeared to contradict the energy security

imperatives of the National Mission on Biodiesel. Moreover, India was concurrently negotiating a civilian nuclear deal with the United States, which was believed to form the groundwork for the establishment of large-scale nuclear power capacity in the country. Interviewees noted that such efforts undermined India's pledge to 'fuel its economic development with green energy'.

3.6.6. CAN THESE TENSIONS BE NEGOTIATED?

The National Mission on Biodiesel appears to have acknowledged the potential discrepancy between the 'pro-poor' and 'pro-growth' potential of biofuel. Under the scheme, private enterprises can lease lands from states to develop biodiesel plantations and processing facilities. The scheme has also identified particular areas and households that are eligible for government support in the form of free or subsidised *Jatropha* seedlings, along with buy-back guarantees and a minimum purchasing price.

In practice, interviews revealed differing opinions as to how the involvement of private enterprises as prominent actors on the emerging biodiesel scene would translate into rural development outcomes. According to one respondent, "[industry representatives] are not that bothered about whether the farmers are benefiting or not". The same interviewee contrasted the case of *Jatropha* with the case of *Mentha* (mint):

> "*any crop [such as Jatropha or Mentha] that is expected to yield value down the line along the value chain...All of that value goes to someone else; not the farmer. The result [with Mentha] was that farmers started growing it and the price dropped. The buyers are now calling the shots. The value of the crop has gone down; diversification [of agricultural production] has gone down; and ultimately, the farmers' interests have suffered. I see something like this happening with Jatropha as well*".

Industry representatives, in turn, maintained that the 'closed loop' set up pursued by biodiesel firms in India will cut out the middle-men, because companies will source feedstock directly from farmers thereby ensuring that they gain immediate benefits.

In efforts to promote the rural development potential of biodiesel, the National Mission on Biodiesel was to be integrated with existing rural development programmes – both in terms of funding and implementation mechanisms. However, as chapter 5 will argue, these mechanisms are themselves highly complex and their ability to meet the needs of disadvantaged segments of society is disputed. Chapter 5 argues that by relying on such programmes to deliver benefits to marginalised communities, the National Mission on Biodiesel jeopardises its potential for change.

3.7. THE INTERPLAY BETWEEN THE GLOBAL AND LOCAL

A map of the 'global' biofuel policy discourse identifies energy security, rural development, agricultural revitalisation, environmental sustainability and economic growth through international trade as core rationales for the development of biofuel. Reflecting the biofuel discourse in India – and particular as it has proceeded around the National Mission on Biodiesel – against its global counterpart reveals some correlation between the two. The rural development concerns of the global debate are expressed in the agrarian distress narrative in India, and the National Mission on Biodiesel proposes to redress this crisis through the development of biodiesel. The country is experiencing a rapid rate of economic expansion, which is bringing in its wake the need to secure a sustainable and domestic supply of energy that does not transgress its commitments to environmentally sustainable development. In this way, the Indian debate echoes the energy-environment-economy nexus of the global policy discourse. In other words, a

process of 'localising the global' can be detected. In part, the correlation between 'the global' and 'the local' can be accounted for by the 'starkness' or 'simplicity' (Keeley and Scoones 2003) of the former discourse, which allows it to claim widespread applicability. By speaking in generalisations, global discourses are able to amalgamate more nuanced local contingencies under its auspices.

Mol (2007) builds on this notion by suggesting that the recent proliferation of biofuel initiatives worldwide should be seen as the result of the emergence of a 'global integrated biofuel network'. This network encompasses individual countries – both developed and developing – as well as major actors on the global energy markets, along with environmental and developmental non-governmental organisations. Echoing assertions by Ferguson (1992) and Escobar (1995) of the totalising impact of technology-development discourses, Mol (2007) maintains that the growing 'global integrated biofuel network' subsumes its small-scale, local equivalents. As a result, he argues, the perspectives of small-scale farmers and other, poor and marginalised communities are dismissed. Moreover, specific local environmental sustainabilities are compromised in the name of combating 'global climate change' (*ibid*).

Despite such influences, there are indications in the Indian context that the effect of 'the global' on the national debate has been far from totalising. Narratives that reflect the contingent circumstances of India are clearly identifiable in the National Mission on Biodiesel document. Indeed, the initiative is distinctly *Indian* in nature; while there are references to experiences from the United States, the European Union, Brazil and other contexts in the National Mission on Biodiesel, it does not appear to have taken its cue directly from global policies. The subsequent chapter seeks to account for this emphasis on the *national* character of biofuel developments.

3.8. CONCLUSIONS

Biofuels have been the focus of considerable debate in recent years. Uncertainty over the availability of crude oil and fluctuations in its market price, a growing consensus behind the need to mitigate climate change and to protect the environment alongside a desire to diversify agricultural livelihoods have all stimulated the global interest in biofuels. Yet, despite the apparently strong impetus for biofuel, its merits and demerits prompt lively debates. Biofuels are often touted as climate-friendly alternatives to their fossil fuel -based counterparts; still, the opposing argument is equally staunch in its insistence that the production of some biofuels is more carbon intensive than conventional fossil fuel use. The ecological impacts of biofuels rouse equally polarised standpoints. On the one hand, 'biofuel cultivation' is said to lead to habitat loss; on the other, it is claimed to counteract land degradation. Equally, biofuel production is feared to directly threaten food security and to exacerbate poverty. Yet, it is also seen as a means of generating rural employment and expanding access to energy, and hence, improving livelihoods.

Upon closer examination, biofuel unfolds as a multifaceted technology, entailing different forms of energy, feedstock, production techniques and potential uses. All of these factors have particular implications for energy security, the environment, agriculture and development in specific climatic, agronomic and socio-economic settings.

The preceding discussion has turned to analytical concepts from Development Studies as well as Science and Technology Studies to gauge the set of rationales – both global and local – that have shaped the National Mission on Biodiesel in India. At their core, biofuel policy discourses embed concepts of 'technological determinism' and

'development as modernisation'. These favour science and technology as the means of transforming societies. In the case of biofuel, the transformative aspirations include the revitalisation of the rural economy, environmental regeneration, along with trade in biofuel commodities as well as carbon credits.

The analysis identified two scenarios that appear to crystallise the ambitions of the National Mission on Biodiesel. These 'pro-poor' and 'pro-growth' scripts appeared to entail distinct institutional arrangements in order to materialise. Indeed, the success of the initiative appears to hinge upon the bridging of these two narratives and the stakeholder communities that sustain them. While the National Mission on Biodiesel seems to have recognised this, the means through which it proposes to reach its 'pro-poor' goal is highly uncertain, as chapter 5 will show.

The subsequent chapter turns towards examining the actors and processes through which the 'pro-poor' and 'pro-growth' narratives and their building blocks became embedded within the National Mission on Biodiesel – in other words, the policy processes that led to the articulation of the Mission. In doing so, the chapter seeks to comment upon the relationship between science and policy within the context of development in India.

CHAPTER 4: FROM NARRATIVES TO MISSIONS – EXPERTISE AND POLICY

4.1. INTRODUCTION

The previous chapter outlined the biofuel policy discourses and their underlying narratives that inform biofuel development both on a global scale as well as on a local scale in India. This chapter builds on its predecessor by exploring how particular narratives gain legitimacy and how the dominant ones become embedded into policy initiatives. It uses the lens of 'technocracy' – in its simplest terms, a union between technology and politics – to understand how a biodiesel path has been paved in India at the policy level.

By committing independent India to a course of 'development through modernisation' – a concept that was introduced in chapter 3 – and by emphasising the role of science and technology in this process, India's post-independence leadership contributed towards institutionalising a culture of technocratic policy-making . Early technocratic culture mirrored India's socialist system, which emphasised publicly-owned and -planned means of economic production. However, the liberalization of India's economy in the past two decades has transformed the relationship between science, technology and their broader settings. The constituency of the technocracy has expanded to include the private sector, civil society and non-governmental organisations. Whereas past science and technology initiatives in India were largely devised and coordinated by Delhi-based politicians, bureaucrats and scientists, current schemes emerge from complex negotiations among a diffuse network of influence and power. Nevertheless,

the importance of science and technology in India's socioeconomic spheres remains largely unchallenged; the technocratic culture has showed remarkable staying power in the face of deep transformations.

This chapter explores the emergence of the National Mission on Biodiesel against the changing context technocracy. The discussion begins with an overview of the process that gave rise to the National Mission on Biodiesel, as described in official documentation. It argues that inherent within such processes are notions of scientific knowledge as objective and definitive. They also evoke an image of 'policy as prescription' (Mooij and de Vos 2003), which tends to view policy-making as a rational problem-solving exercise and to presuppose an instrumental relationship between policy intentions and policy outcomes. According to this stance, society consists of a set of variables that can be manipulated through appropriate policy interventions to meet specific policy objectives.

These propositions, however, have been critiqued on various accounts. Science and Technology Studies have questioned the commonly held assumptions regarding the nature of scientific knowledge by describing its socially constructed nature. Moreover, various academic traditions have challenged linear conceptualisation of policy-making, arguing instead that policy initiatives emerge from contestations and negotiations, and that they are continuously transformed during their lifecycles.

These insights have informed a closer investigation of traditions of policy-making in India, and how they reflect upon the case of the National Mission on Biodiesel. The discussion draws on data collected through documentary analysis and semi-structured interviews with stakeholders, who followed the deliberations leading up to the

National Mission on Biodiesel at close hand or participated in them. More specifically, this chapter seeks to answer 'which actors are involved', 'whose interests are served' and 'whose knowledge is included or excluded' in entrenching particular narratives of biodiesel and its role in rural development into the Mission.

The chapter is structured as follows. Section 4.2 reviews the official depiction of the process that led to the formulation of the National Mission on Biodiesel. Sections 4.3 and 4.4 describe the backdrop for this process by examining the traditional and contemporary relationships between science, technology and expertise in India. It finds a culture and context of policy-making that is undergoing significant changes. Section 4.5, in turn, draws on qualitative data from interviews to unearth stakeholders' experiences of the formulation of the National Mission on Biodiesel. These suggest that the articulation of the initiative was a far more complex process than the official depiction implies.

4.2. The National Mission on Biodiesel: An exercise in technocracy

The Committee for the Development of Biofuel was established in 2002 by the Planning Commission of India, which is itself responsible for producing five-year plans to guide India's economic development. The Committee was given the task of devising detailed recommendations on how to organise biodiesel development in India as a means of addressing various challenges, including rural poverty, energy security and environmental sustainability. A year later, the Committee published a report, which recommended that biodiesel should be the initial priority. This prompted a process to devise the National Mission on Biodiesel, which would set out financial incentives, devise the necessary institutional infrastructure, as well as identify the appropriate biodiesel feedstock and areas of cultivation (Mohan, et al. 2006; Planning Commission

2003). The Mission itself was also published in 2003, and the scheme quickly became a flagship of India's overall biofuel ambitions.

The Committee on the Development of Biofuel included senior officials from the Planning Commission along with their colleagues from the Ministries of Finance, Railways, Surface Transport, Petroleum and Natural Gas, Rural Development and Environment and Forests. Other committee members included high level representatives from the Council for Scientific and Industrial Research (CSIR), the Indian Institute of Petroleum (IIP), the Indian Council of Agricultural Research (ICAR) and the Indian Council of Forestry Research and the Environment (ICFRE).

Also invited were senior officials of The Bureau of Indian Standards, the Central Pollution Control Board, All India Distiller Association and the National Oilseeds and Vegetable Oils Development (NOVOD) Board. Further members included a senior scholar from the Indian Institute of Technology (IIT) Centre for Rural Development and Technology, as well as the director of the All India Automobile Manufacturers' Association, the director of an NGO, a senior member of local government as well as the director of a public renewable energy company. The composition of the Committee suggested that the resulting policy initiative would have the backing of high-ranking delegates from various spheres of society (Planning Commission 2003).

In drafting the National Mission on Biodiesel, the Committee on the Development of Biofuel solicited advice from a range of expert sub-committees. These sub-committees deliberated numerous topics, including standards and quality aspects of biofuel, the role of non-governmental organisations (NGOs) in promoting biofuel, and environmental issues pertaining to its production and use. Figure 4.1 below depicts the relationships between the Planning Commission, the Committee on the Development of Biofuel, and its various sub-committees (Planning Commission 2003).

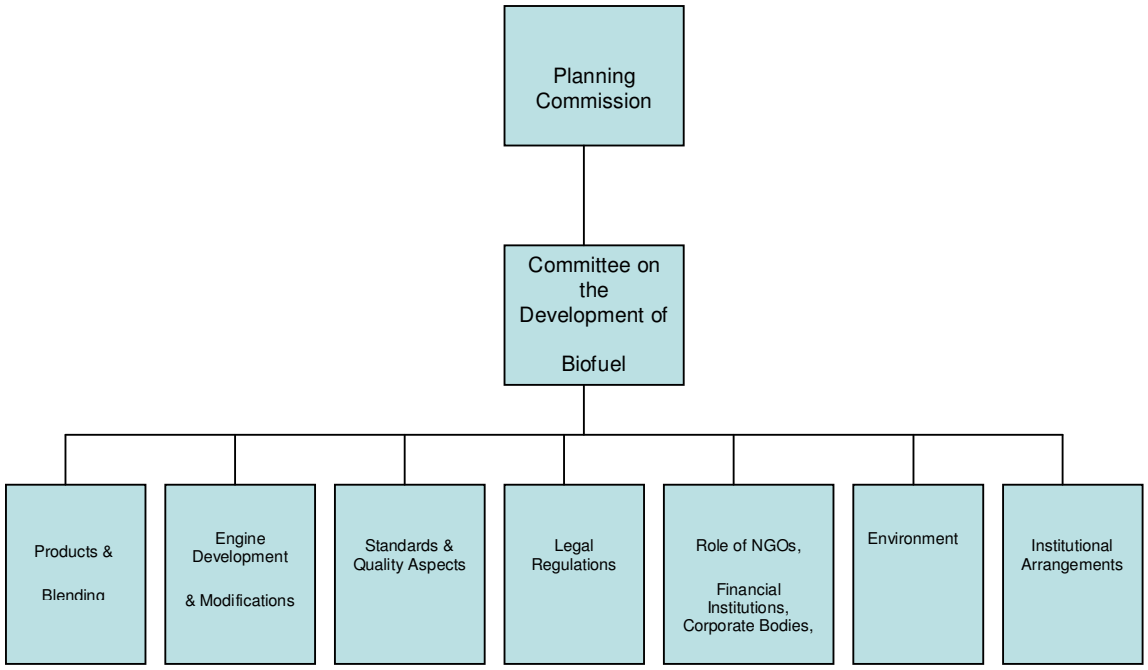

FIGURE 4 INSTITUTIONAL FRAMEWORK FOR DEVISING THE NMB

This static representation of the relationships between policy-makers and experts reflects a widely held view of policy-making. According to this perspective, policy-making occurs in a linear fashion, following a sequence of stages from agenda setting to policy formulation, implementation and evaluation (deLeon 1999). Experts are called upon to speak "truth to power" (Price 1965; as cited in Jasanoff 2003, p. 161). They analyse problems and define solutions to them on the basis of their specialist and

definitive knowledge. They are seen as rational, objective and neutral by virtue of their 'science-mindedness' (Fischer 1990).

Their 'impartial conscience' and 'neutral competence' (*ibid*.) ensures that the interests and value preferences of politicians will not tarnish policy-making. Indeed, technocracy arose as a means of 'cleansing' policy from the contaminating effects of external politics. "Rational, analytical and scientific methods" (Stone 1989; as cited in Fischer 1990; p. 21) were thought of as a means of replacing the "irrationalities and indignities of politics" (*ibid*.; p. 4), such as group competition, bargaining and compromise.

Science has, thus, enjoyed a privileged position in the political sphere. This union between politics and science has been described as 'technocracy' (for instance, Fischer 1990). Technocracy reflects a distinctly Western worldview; its ascendance coincides with the Enlightenment in seventeenth century Europe and later periods of industrialisation (*ibid*.). Technocracy envisions a society guided by technical elites, who abide by the principles of scientific and technical rationality. Informed by positivist philosophy, the notion of scientific rationality implies that empirical measurement and analytical precision (cornerstones of the scientific method) are the only means of attaining valid knowledge.

When extended to the policy sphere, technocracy suggests that the scientific method will reveal the laws of society and enable the rational resolution of socio-economic challenges. Society is depicted in abstract and technical language and it becomes disconnected from its cultural, historical, linguistic and other traditions: "[The positivist] form of thought creates an illusion of cultural and historical transcendence, which in turn sustains a sense of political, cultural and moral neutrality" (Fischer 1990;

p. 42). Policies devised on the basis of expert recommendations, therefore, command a particular authority and universality.

Technocracy has not traditionally been subject to public scrutiny; instead, it is 'quiet' and 'faceless' (*ibid*.). Based on his analysis of the United States policy process, Fischer (1990) argues that experts tend to occupy a position of relative autonomy within the political structure, mediating policy decisions and directing their implementation. Technocratic tenets imply that "economic and political guidance becomes more a problem of planning and management than an issue for public deliberation and, as such, is seen as a job for which only the experts are uniquely equipped" (p. 16). Experts, whether implicitly or not, serve to shield political decision-makers from public accountability. Consequently, Fischer (1990) argues that "technocracy…is…a deep-seated challenge to democracy and its political form of decision-making" (pp. 23-24).

The subsequent section provides an outline of the post-independence ties between science, technology and politics in India. It suggests that the technocratic ethos has established a particularly strong foothold among India's scientific and policy communities. The official depiction of the deliberations leading up to the National Mission on Biodiesel would appear to be a simple extension of the technocratic culture.

4.3. Science, technology and policy in newly independent India

Interactions between scientific and technological experts and policy actors in India have been documented since the colonial era (Habib & Raina 2007). These interactions were continued, if not strengthened, in the country's post-independence period. India's first prime minister, Jawaharlal Nehru, was committed to modernising the country through science and technology (for instance, Corbridge and Harris 2001). He famously

referred to dams as 'the temples of modernity' and advocated 'a scientific temper' for India's citizens (Scoones 2006).[11] Nehru set his sights on transforming India's industrial production through large-scale technological projects. It was under his leadership that the Council for Scientific and Industrial Research (CSIR), the Atomic Energy Commission and the Planning Commission took shape; and it was within these institutions, and their subsequent counterparts, that scientific and technological expertise were brought to bear on policy-making. The Planning Commission was to become particularly pivotal: it spawned a tradition of centrally-coordinated science and technology projects aimed at fuelling India's socio-economic development (Scoones 2006).

While India's early community of policy advisers was dominated by physicists and engineers and aimed primarily at accelerating industrial production, new concerns emerged in the post-Nehruvian era in the mid-1960s. Nehru's successor, Shri Lal Bahadur Shastri, redirected the efforts of science and technology towards agriculture (*ibid*.). It was under Shastri's minister of agriculture – C. Subramaniam – that the Green Revolution began to take shape. Plant breeders and agricultural scientists defined this new era of technology-policy ties. A network of agricultural research institutes and universities – under the umbrella of the Indian Council of Agricultural Research (ICAR) – along with an extensive bureaucracy, were set up to implement the Green Revolution. Although funding and technical advice were solicited from abroad, the Green Revolution was largely cast as national endeavour. Indeed, a nationalistic undercurrent has run through many of India's large-scale science and technology projects (*ibid*.). To add credence, these early efforts were often equated with high profile and

[11] Indeed, Article 51A(h) of the Indian constitution calls on citizens to "develop the scientific temper, humanism and the spirit of inquiry and reform" (as cited in Scoones 2006; p. 81; footnote 1).

internationally-recognised Indian scientists. The Green Revolution in India, for instance, became virtually synonymous with Dr. M.S. Swaminathan (*ibid.*).

Who were the members of this immediate post-independence generation of scientific and technological experts? Class, caste, education and social position played a role in forging the early 'knowledge elites'. The initial links between science and the policy circles in independent India were forged primarily among members of the Brahmin elite.[12] The key experts – or "science czars" (Scoones 2006; p. 54) – were scientists of high standing in the national and international scientific communities. It was their scientific reputation that made them "above reproach and beyond critique" (*ibid.*). These experts devised projects in line with the political concerns of the day. They also served to ensure that their research fields received the required resources and promoted the reputation of Indian research abroad. These key experts have continued to hold powerful positions within India. Among them is the scientific adviser to the prime minister, Abdul Kalam, who subsequently became India's president. Indeed, Dr. Kalam used his Independence Day address in 2005 to exalt the benefits of biofuel:

> *"We have nearly 60 million hectares of wasteland, of which 30 million hectares are available for energy plantations like "Jatropha". Once grown, the crop has a life of 50 years. Each acre will produce about 2 tonnes of bio-diesel at about Rs. 20 per litre. Biodiesel is carbon neutral and many valuable by-products flow from this agro-industry...What is needed is a full economic chain from farming, harvesting, extraction to esterification, blending and marketing. Apart from employment generation, bio-fuel has a significant potential to lead our country towards energy independence"* (Kalam 2005).

Thus, the initial technology-policy ties hint at a tradition of technocratic politics in India – a country, which is frequently touted as the world's largest democracy. Some scholars have come to describe India's commitment to democracy as 'an anomaly' (for instance,

[12] In India's traditional caste system, Brahmins (priests and scholars) occupy the highest stratum.

Kohli 2001). Yet, Fischer (1990) suggests that technocracy directly defies democratic systems of politics. How has a technocratic culture gained a foothold under such circumstances? One explanation might be offered by the 'style of politics' in India, which Kohli (2001) describes as "radical in tone, conservative in practice" (p. 2). As discussed previously, this approach to politics has resulted in elites feeling "well served by the system" while "weaker groups do not feel totally excluded or hopeless" (*ibid*.).

4. 4. SCIENCE, TECHNOLOGY AND POLICY IN THE CONTEMPORARY CONTEXT

However, the context of technology-policy interactions in India has changed in the past two decades, which potentially challenges the wisdom of the technocratic paradigm. India's contemporary political economy has been described as 'The New Economy' (for instance, Scoones 2006). This term is frequently used as shorthand for changes in the relationship between central and state governments; the increased fiscal independence of states and the importance of securing foreign investment directly at the state level. As a result, there has been a gradual erosion of centrally-planned and -funded programmes, and a growing importance has been placed on the private sector and knowledge-based industries. The central government state has become less interventionist in terms of planning and implementing scientific and technological projects, playing instead a more regulatory role. (Jenkins1999). The New Economy has been described as a partial neo-liberal turn.

How do technological expertise and policy interact within the contemporary setting? The standing of science and technology has not diminished. Rather, the sphere of scientific and technological activity is today characterised by new innovations – among them, information and communications technologies and biotechnologies – and new actors, implying also a new culture of technology-policy interactions. In contrast to the

vast technological initiatives of the past, these new applications tend to be smaller in scale. They are also increasingly under the ownership of the private sector and they are distinctly cross disciplinary in nature, necessitating a broader range of often transient collaborative linkages (Scoones 2006). Reflecting this current setting, the ties between science, technology and politics in India are today forged amongst not only by politicians, public sector scientists and civil servants, but also scientists and entrepreneurs from the private sector in India and abroad. A marked feature of the contemporary scene is the global connections of local policy initiatives (*ibid.*). The Nehruvian concept of national, centrally-planned science and technology initiatives, spearheaded by readily identifiable patrons, seems to be an artefact of the past.

In this new context, the constituency of the knowledge elite has broadened, and contemporary policy around science and technology emerges from complex and nuanced negotiations amongst a network of actors (Scoones 2006). These networks are diffuse; it is increasingly difficult to locate a single locus of power. Policy initiatives are moulded from competing interests, narratives and coalitions, and there are few signs of expert recommendations being the sole or even primary drivers of policy processes. If 'science-government' expertise was important in devising successful science and technology policies in the past, then today it is expertise in 'science-industry' that is required (*ibid.*).

Although the community forging technology-based policy may have expanded, it remains the domain of elite experts (Scoones 2006). Policy is framed by 'stealth' (Jenkins 1999) – "a quiet, behind the scenes approach" (Scoones 2006; p. 205). Initial negotiations among policy actors are informal and existing relationships and new alliances are mobilised to build consensus. Only once verbal agreements have been

made is it meaningful to draw up formal documents. It is on the basis of these that broader political and popular approval is sought. Indeed, the Indian civil service views open and widespread consultations with scepticism (*ibid*.). They are seen as leading to endless debates, with little probability of reaching a consensus. Once a core group has agreed upon a policy narrative, it is released for wider deliberation. The initiatives are 'sold' through, for example, trade fairs. It may not be the specific content of a policy initiative that is important in winning over supporters; rather, it is the 'mood' that the initiative is able to create. Policy initiatives are about establishing a direction for others to follow (*ibid*.).

As a caution, Scoones notes that there is a limit to the extent to which policy can be a matter for elites. The importance of electoral politics – and in particular, India's sizeable rural electorate – has not diminished in the context of the New Economy. Balancing the interests behind increasingly private and global technologies with those of the local rural populace presents its own set of challenges.

One means of catering to the plurality of interests is to cast single policy initiatives as meeting multiple goals (*ibid*.). Indeed, in the case of biotechnology in Karnataka, political rhetoric blended messages of rural development with the importance of science and technology for sustaining a knowledge-based economy. These facets may be wrapped in a single message or carefully targeted at particular audiences. In the case of biotechnology policy in Karnataka, the debate was compartmentalised so that a "high-tech, new economy vision" (Scoones 2006; p. 214) was promoted in the English language media, and the rural development and agricultural benefits of biotechnology were set out in the local language press.

The subsequent section investigates the process behind the formulation of the National Mission on Biodiesel against this review of past and contemporary science, policy and expertise interactions. It builds on the analysis of interview data to draw out some of the main themes that characterised the process. The interviewees represented research organisations, non-governmental organisations, the civil service and the private sector, and their work directly touched upon biofuel. Some of the respondents had directly participated in the formulation of the National Mission on Biodiesel. What emerges is an account that is more intricate and 'messy' than the official depiction would imply.

4.5. The policy process behind the National Mission on Biodiesel

Chapter 3 identified the narratives that formed the building blocks of the National Mission on Biodiesel. This section seeks to explicate the processes through which they became enshrined in the Mission, with particular reference to the past and present contexts of science-technology-policy interactions.

4.5.1. The role of the science czar

At first glance, it seems that the process that gave rise to the National Mission on Biodiesel is reminiscent of the traditional relationship between science and politics in India. The momentum for devising the initiative came from the Planning Commission, which solicited advice from sub-committees of experts representing a range of fields. Interviewees particularly highlighted the role of the chairman of the Committee on the Development of Biofuel, Dr. D.N. Terwari, who was also a member of the Planning Commission. Dr. Tewari is the former director-general of the Indian Council for Forest Research and Education (ICFRE), which had been involved in research on alternatives to fossil fuel. According to one interviewee, these experiences prompted him to "push

the issue of biofuels in India as a project of…the Planning Commission". Respondents noted that Dr. Tewari's standing ensured that this impetus was credible, although one interviewee commented that Dr. Tewari also showed particular political prowess. Dr. Tewari resembled a 'science czar', who straddled the spheres of both science and government. This appears to have enabled him to successfully mobilise the backing of critical actors within the Planning Commission for the NMB initiative.

4.5.2. STABILISING CLAIMS IN THE FACE OF UNCERTAINTY

The National Mission on Biodiesel centres on *Jatropha* as the crop of choice for biodiesel production. *Jatropha* is argued to be particularly suited to the task because of its ability to improve the productivity of fallow or non-cultivated lands in non-irrigated areas.

However, some interviewees felt that, in its final form, the biodiesel initiative over-emphasised *Jatropha*. One respondent – who contributed to the deliberations – described the situation as follows:

> *"[I]t is seen as a miracle crop; a situation in which everyone gains. While the original idea was to cultivate Jatropha on marginal lands, gradually it has become a message of 'just grow Jatropha, just grow it anywhere'".*

According to the interviewee, "a mythology has been built up [around *Jatropha*]". This mythology became so dominant that alternatives – such as *Pongamia*, which has been studied in India as a potential feedstock for biodiesel since the 1970s – were bring crowded out. The respondent suggested that the '*Jatropha* hype' had prompted farming communities in productive agroclimatic conditions to replace established and successful crops with *Jatropha*. The respondent cited north-eastern India as an example

of a region where sunflower has been successfully cultivated as a feedstock for biodiesel. However, sunflower was rapidly giving way to *Jatropha*:

> *"People there are talking about growing Jatropha. I say 'for God's sake, please don't go anywhere near it'. Farmers are being led to believe that this is a crop with huge value".*

According to the respondent, the "boundary conditions" (or the environments where *Jatropha* cultivation could prove beneficial) have not been properly set. As a result, there is a risk that "the utility of *Jatropha* will collapse".

Jatropha as the preferred feedstock for biodiesel production was, therefore, contested during deliberations. Yet, the narrative of *Jatropha* became so influential that there seemed little room for other options. According to interviewees, industry representatives were among the most vocal supporters of *Jatropha*. Indeed, private companies appeared to be very prominent actors in the nascent biofuel scene in India. They were proceeding on the impetus given by the NMB to set up feedstock plantations and processing plants. Moreover, these companies had detected latent business opportunities India's countryside. One respondent from a private sector firm noted:

> *"To give you a general idea - all of the big private corporate sectors in India are looking towards the rural sector for their businesses. Almost 70% of our population stays in rural areas. Yes, you do hear that farmers have committed suicides, but actually some of them have large sums of money or large land-holdings".*

Thus, despite uncertainty around the performance of *Jatropha*, the NMB deliberations appeared to have reached a tentative consensus regarding its suitability for the biodiesel scheme. The remainder of the scheme was formulated on the basis of this consensus.

4.5.3. BROADENING THE CONSTITUENCY OF POLICY ACTORS: MORE INCLUSIVE POLICY PROCESSES?

In addition to private sector representatives, the deliberations for the National Mission on Biodiesel also included non-governmental and civil society organisations. One respondent – a director of an NGO – acknowledged that the situation is changing in terms of the range of actors that are able to have an input into policy processes: "I would say that the consultation process itself has opened up in the last few years. It involves more actors than it used to". What explains this change? According to the same interviewee, it has come from:

> *"[A] recognition of the changing dynamics of institutions in India; a recognition that expertise is not just something that a few specialist institutions hold. There is knowledge and expertise outside of these. And that delivery mechanisms in the rural areas require participation of NGOs and civil society organisations. [The] government recognises…that a partnership is necessary".*

Civil society in India has long been known to engage in fields such as health, education, environment and social empowerment. More recently, civil society organisations have become increasingly involved in scientific and technological spheres. Their activities go beyond conventional 'technology delivery' to disadvantaged communities; they also carry out research and develop scientific findings into marketable products (Prasad 2005).

Although non-governmental and other civil society organisations are increasingly involved in previously public spheres of activity under the 'New Economy', these developments do not appear to be upshots of economic liberalisation, which began at the turn of the 1990s. Rather, according to one interviewee, civil society and non-

governmental organisations began to participate in policy-making in the mid-1980s as a result of the 7th plan, which had distinct chapters on the inclusion of these actors into the policy process. However, such changes have yet to fundamentally transform the policy process:

> *"[T]here is a difference [in the scope of policy consultations], although in some cases the overall result may not be that different…[Policy-making] tends to be top-down [as opposed to bottom-up], if I have to fall into one or the other category".*

As previously discussed, the notion of open and widespread deliberations is not viewed favourably by all. Scoones (2006) chronicles how the civil service, for instance, regards these wearily and at least initially, prefers a negotiated outcome among a limited community. This appears to have been the case with the process that led to the NMB as well. According to one respondent, "amongst the government level, there always has been [a consultative process and dialogue]". Referring to the possibility that more widespread consultations would lend credibility to dissenting perspectives from other organisations, the respondent commented:

> *"[W]ould you let them come to knock on your door and let you write the policy for your house? No. That is the view that government takes. [But], they will listen and welcome anyone with a proven track record".*

4.5.4. Contested ownership: "It's nobody's baby"

Biofuel is often presented as a convergent technology that spans various sectors – including, energy, environment and agriculture – and that offers manifold advantages. As a result, it would appear to necessitate the enrolment of a diversity of actors in order to be viable.

However, some interviewees expressed doubts as to whether adequate cross-fertilisation has taken place among the stakeholders involved. One respondent suggested that there was no clear driver for the initiative: "what you find is that…it's nobody's baby". The National Mission on Biodiesel identified separate nodal agencies for each of its micro-missions. According to interviewees, the Ministry of Agriculture and Rural Development had been proposed as an overall lead organisation for the scheme. Despite this, there were indications in January 2007 that the leadership of the initiative was for the taking. Interviewees particularly mentioned a vying process between the Ministry of Agriculture and Rural Development and the Ministry for New and Renewable Energy. They speculated that this may have been based on the different views that the ministries held for the future of India's renewable energy. What these distinct views were – and whether the ministries were indeed competing for leadership of the initiative – could not be confirmed in subsequent interviews.

Further uncertainty was caused by the parallel drafting of an overall national biofuel policy. Interviewees maintained that the relationship between the NMB and the emergent policy was unclear. Indeed, as chapter 6 will detail, this new, more encompassing national biofuel policy would supersede the National Mission on Biodiesel in August 2008.

Moreover, interviewees suggested that five years after the publication of the National Mission on Biodiesel, all was not in place for the biodiesel industry to take off. There were doubts regarding the intended market of biodiesel. One respondent commented that "the biodiesel [industry] is not yet a fully demand-driven programme. It is still being partly driven by the producer end to convince the suppliers to take it up".

Instead, it appeared to be the so-called 'intermediaries' – frequently private sector organisations that were establishing biodiesel processing plants – that are a central force in promoting the biodiesel industry.

The contrast with the bioethanol scenario is illustrative:

> *"[Bioethanol] a very demand-driven programme...You've got two clear drivers – the sugar industry [a lobby of farmers with strong political representation in government] and the petroleum industry. That programme is going to take off. This one [the biodiesel programme] doesn't really have an owner yet. So, the guys who are really pushing it are the people who want to set up the biodiesel plants".*

It is not only the lack of a distinct user group for biodiesel and a well-coordinated and powerful lobby that appeared to be impeding the National Mission on Biodiesel from becoming reality. There were also signs that the initiative's focus on *Jatropha* is being re-examined. Indeed, interviewees noted that this had been among the points of contention during deliberations. In February 2007, industry representatives from the state of Andhra Pradesh mentioned that state government officials appeared to have suddenly halted its support for *Jatropha*: "[T]he state government is convinced that there is no right planting material right now and we can't ask the farmer to grow *Jatropha*". Instead, *Pongamia* has re-emerged as an alternative in Andhra Pradesh. The subsequent chapter will examine more closely interactions between the central and state governments in implementing the NMB, with a particular focus on Andhra Pradesh.

4.5.5. HIDDEN ACTORS

Interviews revealed a set of actors, who are not explicitly mentioned in the National Mission on Biodiesel document, yet who they felt were strongly connected to the

initiative. These include organisations that did not have an official role in devising or implementing the scheme, yet that are engaged in research or advocacy in energy, agriculture, environmental and development areas. Such organisations have shaped the biofuel environment by publishing reports or organising conferences. Intermediary organisations provided fora for deliberations outside the formal government structure, and produced publicly-available material that influenced the course of discussions.

Further, the National Mission on Biodiesel states that the scheme:

> *"[W]ill generate massive employment for the poor belonging to the Scheduled Tribes, Scheduled castes and other underprivileged categories living mostly in backward areas which have experienced the adverse impact of forest degradation and loss of natural resources"* (Planning Commission 2003; p. 110).

Although this quote suggests that they are the intended beneficiaries of the National Mission on Biodiesel, these groups are not explicitly mentioned in the outline of 'formal' National Mission on Biodiesel stakeholders (figure 2; chapter 3). The scheme implies that these groups will be accessed through the variety of NGOs and government bodies, whose remits extend to working with such communities. In effect, they act as proxy representatives.

'The landless poor', and 'landless labourers' along with 'the tribals' do not appear to share the immediate agency of 'formal' National Mission on Biodiesel actors – or, indeed, that of the intermediary organisations that 'informally' mould the biodiesel environment. Indeed, some interviewees noted the power discrepancies that existed between the stakeholders implicated by the scheme. The members of the Planning Commission, the Committee on the Development of Biofuel and the various sub-

committees that were consulted in the articulation of the National Mission on Biodiesel would appear to represent the 'heterogeneous engineers' and 'system builders', who were involved in the construction of a complex socio-technical network around the National Mission on Biodiesel. However, for the initiative to be successful, these engineers would have to enrol the support of a broader range of actors, including the ultimate intended beneficiaries. Chapter 5 critically explores the efforts of the National Mission on Biodiesel to bring on board so-called 'underprivileged categories'. It investigates the ability of proxy representatives – such as NGOs and dedicated government bodies – to represent the interests of the marginalised on an equitable basis, as well as to foster a sense of ownership for the National Mission on Biodiesel among them.

4.6. THE DEMISE OF TECHNOCRACY?

The notion of technocracy reviewed at the beginning of this chapter paints a portrait of a sequential process of policy-making, whereby policy is based on the neutral, objective and definitive advice of experts. 'Expertise' and 'politics' are thought to exist in distinct spheres, the former presumably untainted by the deliberations and manoeuvrings of the latter. The 'science-politics' relationship in the 'New Economy' suggest something else entirely.

In the case of the National Mission on Biodiesel, there did appear to be a traditional 'science czar', who played an important role in promoting the initiative. However, he had to contend with a wider community of stakeholders – both in terms of government ministries, whose remits extended to biofuel, as well as actors from the private sector and non-governmental organisations – than would have been the case in the past.

Nevertheless, there were indications that this more expansive constituency did not directly translate into equitable participation in policy deliberations. Rather, the enrolment of particularly non-governmental organisations appeared to be constrained by pre-defined limits. Moreover, the National Mission on Biodiesel appeared to lack clear ownership within the government, despite being presented as a government-led scheme. Indeed, there seemed to be no single locus of power that was steering the initiative forward; rather, a scattered web of actors appeared to be involved – some overtly and others implicitly. If anything, it was the private sector that appears to have been in the strongest position to direct the scheme towards its interests.

According to the technocratic paradigm, policy is based on neutral, objective and definitive knowledge that is untainted by politics. Yet, the deliberations that led to the formulation of the National Mission on Biodiesel indicate, firstly, that knowledge claims were contested; and secondly, that such contentions were resolved among policy – not scientific – actors. Indeed, one interviewee suggested that it was private sector stakeholders who were particularly supportive of the Mission's proposed emphasis on *Jatropha*. They appeared to have been well-placed to override other standpoints, which were more doubtful of the suitability of the crop.

Technocracy implies a culture of politics in which decision-making tends to be centralised and decision-makers draw extensively on the recommendations of an often narrow community of advisers (Fischer 1990). Yet, the deliberations around the National Mission on Biodiesel would appear to contradict these tenets. How can these findings be accounted for?

4.6.1. Alternative perspective on expertise

Technocracy assigns a privileged position to scientific expertise by virtue of its perceived objectivity, neutrality and definitiveness. Science and Technology Studies (STS) have problematised these widespread assumptions regarding the status of scientific knowledge – and indeed the overall social authority of science. As indicated earlier, science has traditionally appealed to its method of inquiry in order to establish its authority with respect to other knowledge systems. STS, however, propose that scientific knowledge-making draws on social norms to guide the emergence of consensus around scientific knowledge claims. It is this consensus that is widely understood as 'scientific truth'.

STS suggest that the production of scientific knowledge occurs in particular institutional, social, cultural, and economic settings that influence knowledge-making. The construction of scientific knowledge claims is influenced by "governing research paradigms, available instrumentation, disciplinary standards of evidence and proof, scientists' hopes of economic and professional rewards and wider social attitudes towards nature and human dignity" (Jasanoff 2003; p. 159) The authority of scientific method, for instance, depends on "pre-existing, negotiated standards of what counts as valid experimentation in a given scientific field" (*ibid*.; citing Collins 1985). Moreover, the production of scientific knowledge is guided by those "with the power to set research agendas" who "may incorporate the biases of gender, culture or nationality" (Jasanoff 2003; p. 160).

According to STS, science and technology are nevertheless able to command a high degree of authority in society because of social processes of demarcation – or boundary work – that distinguish their activities from non-science. Boundary work serves to keep 'science' and 'politics' separate in order to maintain the illusion of objectivity and

neutrality (Gieryn 1983). This reinforces the exclusivity of the spheres of science and technology, which can only be accessed through professional merit (Gieryn 1995). Indeed, Jasanoff (2003) suggests that "[e]xpertise is not so much found as made" (p. 159). Deciding what constitutes 'science' or 'technology' – and who is considered 'an authoritative expert' – involves political decisions.

Boundary work explains how scientific communities produce and maintain internal coherence, and demarcate themselves from 'non-scientific' and therefore less credible claims. How does the resulting scientific authority come to pertain on policy? STS research suggests that scientific experts and policy-makers interact to mutually construct both scientifically sound policy as well as policy-relevant science. "Scientists contribute to the framing of issues by defining what evidence they can produce and by making claims about its significance for policy-makers...[Policy-makers]...delimit areas for scientific enquiry, in the process effectively cutting off certain avenues of research, and the very possibility of the creation of certain facts" (Keeley and Scoones 2003, p. 27). In areas of scientific or policy uncertainty, scientists and policy actors create 'anchoring devices' (Van der Sluijs, et al. 1998) – in the form of specific terminology, objects, statistics, data or procedures – around which to form tentative consensus.

4.7. CONCLUSIONS

The aim of this chapter was to unpick the past and present cultures of policy-making around science and technology in India, and to cast these against the formulation of the National Mission on Biodiesel. What emerges is a picture of a process that bears some of the hallmarks of the earlier period, but that clearly reflects features of the new context.

The National Mission on Biodiesel was in keeping with India's 'scientific temper'. It proposed a scientific solution to current socio-economic concerns of the nation and appeared to embody a degree of technological optimism. In line with the tradition of policy-making around science and technology in India, the National Mission on Biodiesel began as a project of the Planning Commission. Among the factors that contributed to its formulation appears to have been the commitment of the head of the Committee on the Development of Biofuel. According to interviewee accounts, this key individual built on his standing in both the scientific and bureaucratic arenas to mobilise support for *Jatropha* as the crop of choice for the National Mission on Biodiesel. Indeed, he seemed to embody the traditional 'science-bureaucracy' expertise that had been essential in devising large-scale technological initiatives in the past.

There were signs that the scope of consultations had widened beyond the science-bureaucracy axis of the past – both the private sector and non-governmental organisations were represented on the sub-committees. Whether these new stakeholders were able to make meaningful inputs is debateable, particularly in the case of non-governmental organisations. Although the process of devising a policy initiative appeared to have expanded to include a network of actors, it would be incongruous to suggest on the basis of the available data that any one of them had an instrumental effect in devising the National Mission on Biodiesel. Nevertheless, there were indications that the private sector showed particular aptitude in ensuring that the initiative reflected its interests.

According to interviewees, an example of this was the Mission's emphasis on *Jatropha*. Some sub-committee members had reservations about the crop's performance and its suitability to realising the goals of the National Mission on Biodiesel. Although the

Committee on the Development of Biofuel solicited input from these experts, one interviewee felt that dissenting viewpoints were not acknowledged:

> *"That's the way it works. They'll consult a number of people, but finally they will come to the policy recommendations of the few drivers that there are. My views are almost diametrically opposed to how the policy is going now. You'd think that I prescribe to the policy, because my name is there".*

Such 'black-boxing' of uncertainties and downplaying of controversies and contentions often takes places in order for particular policy perspectives to gain the upper hand (Keeley and Scoones 2003; Scoones 2006). Yet, it is precisely at sites of contention – that "occur in the process of developing scientific facts, in official decision-making fora and the implementation of projects, programmes and policies" (Keeley and Scoones 2003; p. 22) – that the boundaries between 'the technical' and 'the political' become indistinct. While an investigation of the process of developing scientific facts behind the NMB was beyond the scope of this research, the data suggest that political negotiations were involved in resolving contention and elevating particular narratives (based on *Jatropha*, for instance) over others (such as the use of *Pongamia* as feedstock).

Scoones (2006) suggests that interactions between politics and expertise serve a range of purposes – "creating surety in the face of uncertainty, offering the basis for hype and linking interest groups in a narrative of success" (p. 79). The process that led to the formulation of the National Mission on Biodiesel echoes these notions. Despite questions, the final document portrays an apparently uncontested plan, whose credibility is based on the backing of high profile politicians, scientists, bureaucrats, entrepreneurs and civil society members. Discord gave way to a stable scheme – or, in the language of Keeley and Scoones (2003), 'a definitive, mobilising discourse'.

The subsequent chapter turns towards the mechanisms through which the National Mission on Biodiesel intended to realise its 'pro-poor' goal. This involved a complex network of so-called governance institutions that exist in the Indian countryside. These institutions are upshots of decentralisation processes that have devolved decision-making powers from central authorities to their local counterparts. They are thought to offer the means through which local communities can participate in the design and implementation of intervention programmes, and represent a shift in development orthodoxy from top-down to bottom-up thinking. As such, these institutions might be thought of as platforms for voicing alternative perspectives. However, the chapter finds that their ability to do so has been challenged along a number of dimensions. Despite their intentions, these institutions may merely serve to perpetuate existing technocratic cultures in bringing technology to bear on development challenges.

CHAPTER 5: 'PRO-POOR' BIODIESEL? TECHNOLOGY AND RURAL GOVERNANCE

5.1. INTRODUCTION

Few contemporary analyses of Indian political economy are able to avoid terms such as 'privatisation', 'liberalisation' and 'decentralisation'. These have been the cornerstones of Indian politics since the early 1990s. Although there are differences between them, the terms insinuate a diminishing role of the state in social and economic spheres. Responsibilities have been transferred from national-level central governments to more local level governments, civil society and supranational organisations, as well as the private sector – both domestic and international (for instance, World Bank 2000b; as cited in Johnson 2003). As a result, there has been a surge of new actors, interests and arenas that must coordinated to articulate desired policy ends and the means of achieving them. These processes occur in neither political nor socio-technical vacuums; rather, issues of legitimacy and power are key concerns. As this chapter will demonstrate, accommodating the resultant degree of diversity and negotiating the power dynamics involved – particularly in the Indian context – is far from straightforward.

Given the often overlapping usage of the terms that describe India's contemporary political economy, it is necessary at the outset of the chapter to spell out the perspective adopted here. This chapter is concerned with decentralisation and governance, particularly as they relate to participation.

Decentralisation is often described according to three dimensions: financial (transfer of financial resources, including grants and tax-raising authority to sub-national government units), administrative (functions performed by central government are transferred to geographically dispersed units) and democratic (devolution of powers and responsibilities to elected local governments) (World Bank 2000a). This chapter focuses particularly on democratic decentralisation.

Decentralisation has rapidly seeped into the international donor community and established itself as 'blueprint' development practice. In these circles, decentralisation has been promoted as a means of improving administrative efficiency and the financial prudence of government; but it has also been envisioned as a means of improving government accountability, public participation and poverty alleviation.

Decentralisation is not a novel concept in India. Mahatma Gandhi had promoted the idea of local self-determination through his vision of *gram swaraj*, or 'village-level rule'. Since India's independence in 1947, successive governments have attempted to establish a system of harmonised local government bodies that extend to villages across the country. A number of Indian states have experimented informally with establishing local government in the form of *panchayati raj* institutions (village assemblies). However, these have remained varied both in form and function. It was not until the early 1990s that constitutional amendments formalised *panchayati raj* as extensions of the central government to village levels.

In practice, village-level rule does not occur solely through formal *panchayati raj*; rather, a range of so-called 'parallel bodies' – including user groups for natural resource management and self-help groups for micro-credit and small enterprise development –

also present arenas for self-determination. Many parallel bodies have been created and are sustained by donors as a way of delivering development programmes. The relationship between *panchayati raj* and parallel bodies is complex: often they are found to compete for legitimacy and resources.

Collectively, *panchayati raj* and parallel bodies form institutions of local governance. The term 'governance' encapsulates the premise that it is no longer singularly or primarily central government that steers decision-making; rather, decision-making authority is granted to a wider range of actors, who often have a direct stake in matters.

It is through this contested landscape of local governance institutions that the National Mission on Biodiesel proposed to realise its 'pro-poor' goals. The chapter begins by reviewing concepts of 'decentralisation', 'governance' and 'participation'. Section 5.3 outlines the means through which the National Mission on Biodiesel intended to channel the envisioned benefits of biodiesel to the rural disadvantaged through local governance institutions.

Section 5.4 then surveys previous experiences of delivering development programmes through local governance institutions, focusing particularly on the terms of participation in *panchayati raj* institutions and parallel bodies. In doing so, it seeks to answer whether such institutions are able to integrate different interests and knowledge systems, and in the process, deliver more responsive policy and development projects. Section 5.5, in turn, focuses on such processes within the state of Andhra Pradesh. This locale was chosen, firstly, due to the availability of data on local governance within the state; and secondly, due to the high level of interest that the state has shown in biodiesel development. Section 5.6 synthesises some of the

implications of the analysis for the National Mission on Biodiesel. Section 5.7 concludes the chapter.

5.2. Whose voice is heard? Decentralisation, governance and participation

During the course of the past two decades, democratic decentralisation has become received wisdom in both the developed and developing worlds. A number of complex and interconnected factors are said to be behind its emergence. Decentralisation has gained currency as conventional centrally-planned and state-led development has come under criticism for producing structures and mechanisms of government that weaken national economic growth and undermine efficient public policy (Gore 2000; Johnson and Start 2001; as cited in Johnson 2003). Such development has been said to overlook 'time and place' (or 'local') knowledge; to lack flexibility; and to encourage rent-seeking behaviour (or the misuse of official authority to seek financial and other benefits) among officials.

Democratic decentralisation has been proposed as a means of correcting the ills of conventional top-down development. It has promoted as an effective mechanism for overcoming poverty and inequality in developing countries in a participatory and needs-driven manner. Under democratic decentralisation, citizens are brought into contact with the state at a more local level, and are given the authority to endorse or reject the state through local elections. Democratic decentralisation is also assumed to enhance pluralistic participation. It is said to bring manifold benefits, including "equity through redistribution and enhanced social welfare; poverty alleviation; effective development through local voice in development planning and monitoring; greater

state responsiveness; improved governance processes such as greater participation, transparency and accountability; mitigation of inherited social inequalities such as caste and gender; women's empowerment; [and]...collective action" (Jayal 2006; p. 6).

Indeed, one of the goals of the decentralisation of authority to local level institutions is to improve 'governance'. Governance is a complex notion, which is at times used as an explanatory framework and, at others, as a normative agenda (for instance, Mohan and Yanacopulos 2007). In terms of an explanatory framework, governance describes a proliferation of state and non-state actors, who share among them political power. It denotes the redistribution of authority from a traditional nation-state to a wider and often diffuse network of actors. In terms of a normative agenda, governance has become shorthand for expanding participation in framing goals, issuing directives, pursuing policies and changing norms (World Bank 1992; citing Rosenau 1995).

Thus, the success of governance processes is said to rely on the participation of the citizenry. It is through dismantling the paradigm of centrally-planned, -financed and -implemented schemes, and by enrolling stakeholders into initiatives, that 'more and better development' can be achieved. Decentralisation is thought to facilitate governance processes by presenting new opportunities for people (particularly from marginalised communities) to participate in making and implementing decisions that directly affect them – in other words, engaging in processes of governance.

It follows that the agenda of 'good governance' is readily equated with 'more participation', although the former consists of elements beyond the latter. Rooted in a Western, liberal democratic ideology, participation tends to assume that individual citizens have certain universal rights in relation to the state – including the right to

participate in democratic politics – and that they are able to exercise these rights on an equal basis. It remains the responsibility of a 'benevolent state' to oversee such engagement (Leach, Scoones and Wynne 2005). This liberal democratic perspective has informed much of contemporary development practice. Citizens are thought of as beneficiaries or users of public services provided by the developmental state, or more recently, as customers in an open market of development options (*ibid.*).

However, there are limits to the extent of participation that takes place. In practice, engagement in decision-making tends to be limited to choosing from various options that have been pre-defined by experts (Gaventa and Cornwall 2001; as cited in Leach Scoones and Wynne 2005). Indeed, "liberal theories of democracy...defer decisions to elected elites, who historically have been highly reliant on accredited scientific and technocratic expertise" (Leach, Scoones and Wynne 2001; p. 22).

The union between expertise and decision-making was a core theme in chapter 4. Among others, the chapter argued that technical expertise relies on a modernist worldview, which elevates scientific and technological understanding above other ways of knowing. Yet, participation seeks to bring 'local' or 'lay' knowledge to bear on often technical issues. What happens when modernist, technology-centric 'formal' expertise encounters its 'lay' counterpart?

Using the example of environmental policies in Zimbabwe, Keeley and Scoones (2003) investigated whether participatory processes challenge or reinforce the conventional technocratic tenor of policy processes. They conclude that participation "has remained limited to renegotiations over technical knowledge, with little evidence of more direct challenges to structural issues of politics and power" (Keeley and Scoones 2003; p.

160). Such evidence gives credence to the view that 'participation' is little more than "a diversionary tactic, effectively extending mainstream discourses" (Keeley and Scoones 2003; p. 149) that depoliticise development interventions. In similar vein, Cooke and Kothari (2001) have described participation as 'the new tyranny'. According to the authors, the agenda of participation makes naive "assumptions about the authenticity of motivations and behaviour in participatory processes" (p.14). It ignores "how the language of empowerment masks a real concern for managerialist effectiveness; the quasi-religious associations of participatory rhetoric and practice; and how an emphasis on the micro level of intervention can obscure, and indeed sustain, broader macro-level inequalities and injustice" (*ibid*.).

How do these insights reflect against experiences of decentralising and facilitating participation in decision-making in India? In the Indian context, such processes have been promoted through *panchayati raj* institutions and parallel bodies. The subsequent sections seek explanations to the patterns of participation that they support. Among others, the discussion finds that attempts to enhance public engagement in decision-making through decentralising authority have yielded uneven results. *Panchayati raj*, for instance, tend to be co-opted by civil servants, high-level politicians and other elites, suggesting that "it becomes difficult in practice to combine or balance the principles of expertise with those of democracy and accountability" (Jayal, et al. 2006; p. 11).

The intention of highlighting these insights is neither to condemn at the outset the outcomes of the National Mission on Biodiesel, nor the feasibility of participation in 'technology for development' schemes through *panchayati raj* and parallel bodies. Rather, it is to reveal the challenges of participatory practices and institutions, which if

ignored, jeopardise the potential benefits of schemes such as the National Mission on Biodiesel.

5.3. Realising the pro-poor goals of the National Mission on Biodiesel

Although the dichotomy between 'pro-poor' and 'pro-growth' strategies of biofuel development need not be mutually exclusive, chapter 3 reviewed standpoints that emphasised the distinct institutional arrangements and ultimate distribution of benefits that the respective strategies imply. The state-specific schemes in India reflected these differences: commercial, 'pro-growth' biofuel ventures were promoted by making available land that private companies could lease from the state. 'Pro-poor', rural development efforts, on the other hand, were highly subsidised and implemented through institutions of local governance – the usual channels through which both the Indian state as well as international donors have delivered development programmes. This section looks at the planned implementation of the National Mission on Biodiesel in the state of Andhra Pradesh.

The National Mission on Biodiesel never became official policy (the fate of the initiative is described further in chapter 6); however, various states took their cues from it and began to devise their own policies to develop biofuel. A number of these dedicated specific departments to oversee biofuel development. In accordance with the 'policy mood' (see chapter 4) of the National Mission on Biodiesel, they devised strategies that both encouraged private investment into nascent biodiesel industries and promoted rural development.

The state of Andhra Pradesh is a case in point. Andhra Pradesh allocated primarily non-forest and other land for *Jatropha* plantations. The Rain Shadow Areas Development Department and the Department of Rural Development are responsible for coordinating these activities. The former was established in 2004 with the aim of improving the livelihoods of communities in the rain deficient regions of the state, which are said to be prime targets for *Jatropha* cultivation. Under the National Mission on Biodiesel, Andhra Pradesh began pursuing a multi-feedstock strategy, encompassing *Jatropha*, *Pongamia* and *Posopis Juliflora*, although interview data suggests that until recently efforts have largely focused on *Jatropha*.

Andhra Pradesh encouraged private sector investment into the nascent biofuel sector by offering to lease lands to commercial ventures. Indeed, some of the most high-profile commercial biofuel projects take place in the state. These are described in figure 5 below.

Among the commercial biofuel projects taking place in Andhra Pradesh was a joint venture between Naturol Bioenergy Limited, an Austrian biodiesel technology supplier (Energea Gmbh) and an American private equity fund (Fe Clean), which specializes in clean energy projects. The venture has been constructing a biodiesel processing plant, with a capacity of producing 300 tonnes of biodiesel a day. Naturol Bioenergy Limited has been allocated 120 000 hectares of land for *Jatropha* cultivation, but it will procure seed from alternative sources for the first few years until the trees begin to bear fruit. The venture has financial backing from the Industrial Development Bank of India, Andhra Bank, the State Bank of India, the National Bank for Agriculture and Rural Development, and the Infrastructure Development and Finance Company (Gonsalves 2006; Chan, et al. 2006).

At the time of data collection, Southern Online Bio Technologies Limited was also setting up a bio-diesel processing plant potentially capable of producing 30 tonnes of bio-diesel per day. The company was involved with two public-private biodiesel consortia. The first of these includes the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the German Technical Cooperation Agency (GTZ) and involves exploring both *Jatropha* and *Pongamia* as potential feedstock. Despite being allocated approximately 1000 hectares of land for the cultivation of energy crops, the company is unlikely to be able to procure sufficient feedstock to keep the processing plant running at maximum capacity. Consequently, animal fats will be used to compensate for any shortfall in feedstock. The company's second consortium involves an Indian engineering and technology supply company, Chemical Construction International Ltd. This consortium has an exclusive technical collaboration agreement with a German life sciences company – Lurgi Life Sciences – which is a leader in biodiesel manufacturing technologies (interview data).

FIGURE 5 COMMERCIAL BIOFUEL VENTURES IN ANDHRA PRADESH

In parallel to promoting this 'pro-growth' trajectory, the Andhra Pradesh state government also intended to divert funds from the National Rural Employment Guarantee, the Comprehensive Land Development Programme and Watershed Programme into promoting biodiesel development as a livelihood option in marginalised areas (Rain Shadow Area Development Department website). The state government would bear the costs of setting up and maintaining biofuel plantations for rural communities. It was to cover 60% of initial costs for other farmers and to arrange training for farmers. The Rainshadow Areas Development Authority also devised guidelines for seed procurement, raising nurseries, plantation practices, soil and moisture conservation as well as watering, and arranged for 'technical backstopping' to be available for rural communities.

The 'pro-poor' strategy was be implemented through local governance institutions, including farmers committees, *panchayati raj* and watershed committees. The state planned to channel funding to the *panchayati raj*, which would in turn allocate them to self-help groups and farmers. Farmers' committees were to monitor activities to ensure that the formal guidelines are adhered to (*ibid*.).

The effectiveness of these local governance institutions, however, has attracted much scrutiny – both nationally, as well as within Andhra Pradesh. The state represents a particularly fruitful site for research due to its commitment to pursuing biodiesel development as a rural poverty scheme through local governance institutions (that is, both *panchayati raj* and parallel bodies) and the wealth of material on how such institutions operate within the state.

Building on chapters 3 and 4, the remainder of this chapter is concerned with understanding the rural development potential of the National Mission on Biodiesel. It does so by critically examining institutions of local governance in Andhra Pradesh in order to gauge their effectiveness in delivering the 'pro-poor' benefits of development schemes to rural, marginalised communities. The chapter forms bridges to its predecessors by exploring how narratives can be challenged 'from below' and how the policy debate does not cease at the completion of a seemingly bounded policy formulation stage, but rather transcends into processes of implementation.

The subsequent section reviews literature on 'local governance' in India in general, before focusing specifically on the institutions that facilitate such processes within Andhra Pradesh.

5.4. Democratic decentralisation, local government and participation in India

5.4.1. *Panchayati raj* as arenas for local governance

Section 5.2 reviewed the rationales for promoting democratic decentralisation within the context of development. Among its core justifications was the belief that the decentralisation of decision-making authority would accelerate poverty eradication. In practice, however, various studies have found a weak correlation between democratic decentralisation and poverty reduction (for instance, Crook and Manor 1998; Manor 1999). Instead, decentralisation frequently appears to empower local elites and to shift common resources (such as land) under their control. In this sense, decentralisation might also be seen as a political strategy, whereby national elites can access new arenas of influence. This has become an imperative as the standing of the conventional nation

state has begun to erode following economic liberalisation, political regionalism and the ascendance of international actors (Johnson 2003; Jayal, et al. 2006). As the remainder of this chapter will show, these tenets hold particularly in India.

Indeed, Johnson (2003) has identified a tension between the formal process of decentralisation – whereby the state devolves power – and the informal processes of political economy that shape the functioning of local governance institutions. In India, these informal processes have operated on the basis of class, caste and gender. Critical assessments of democratic decentralisation have argued that it is frequently these informal processes that determine the course and impact of governance in rural societies (for instance, Cross and Kutengule 2001; Harriss 2001; James, et al. 2001).

As mentioned earlier, although the issue of local government in India is not new, it has only recently come to feature on the national political agenda. It was in the late 1880s under British rule that local government structures – or *panchayati raj* – were initially introduced as a means of organising local tax collection and other mechanisms for generating state revenue. Local government also featured on the agenda of the pre-independence freedom movement. While its leadership agreed that local self-rule should be continued, the form that this self-rule should take was debated.

Some prominent nationalist leaders – including Nehru and Ambedkar – favoured a central government with a concentrated power base. Gandhi, on the other hand, advocated the concept of 'the village republic' as the cornerstone of the Indian state. Mitra (2001) casts these distinct visions in terms of a conflict between "the modern and the traditional, the scientific as opposed to the vernacular, the view from above as opposed to the meso and micro perspectives from below" (p. 105). Although Nehru's

vision prevailed, the notion of effective and legitimate local government remained on the agenda. Following independence, the Planning Commission set up a committee to explore a harmonised structure of local government across India, and it was on the basis of its recommendations that a handful of states began experimenting with devolved power.

However, local government receded into the background from the mid-1960s until the mid-1980s as other concerns dominated Indian politics. In the early 1960s, India was faced with a food grain crisis, which was among the rationales for the Green Revolution. The Green Revolution, in turn, established an elaborate system of administration to oversee the production and distribution of agricultural resources across centre-, state- and local-levels. This reinforced a culture of centrally-planned, -financed and -implemented development and poverty reduction schemes. Despite its hiatus from the national political stage, local government did take root in some states across India during this period, including West Bengal, Maharashtra and Bihar.

Thus, decentralisation in its initial form in India offered the means of mobilising natural, political and other resources for the benefit of planned development both at the national and local levels. They were promoted as a means of implementing structural change in a non-violent and incremental manner: "*panchayati raj* offered a middle way between centralised, bureaucratic planning and revolution from below" (Mitra 2001; p. 109) – the competing visions for a newly independent India.

In the early 1980s, Rajiv Gandhi attempted to garner renewed support for the notion of mandatory local governments across India, but it was not until the constitutional amendments of the early 1990s that *panchayati raj* gained formal status. The 73rd and

74th constitutional amendments in 1992 obliged states to establish harmonised structures of local government in rural and urban areas, respectively. The amendments also directed states to hold regular elections through which representatives would be selected to these institutions. Quotas – or 'reservations' – were established in order to enrol women, lower castes and other marginalised groups into these local level political processes. The amendments formalised *panchayati raj* as "institutions of self-government through which the people could participate in the process of planning for economic development and social justice, and also in the implementation of schemes for these purposes" (Jayal 2006; p. 7).

The amendments identified 29 areas that were to become the responsibility of the *panchayati raj*, including agriculture, land, forests, rural industries, health, education, women's and children's development and the social welfare of marginalised and disadvantaged groups (Jayal, et al. 2006). The amendments sought to devolve not only fiscal or administrative powers, but also decision-making authority from central institutions to elected bodies at the local levels. Local government became the official 'third-tier' of the Indian state, after central and state government. As such, *panchayati raj* bodies also offered a new arena for party politics at a sub-state level. The constitutional amendments called for *panchayati raj* bodies at three levels - *gram panchayats* at the block level; *zilla parishad* at the district level; and *gram sabha* at the village level. This form of *panchayati raj* has been described as "the world's largest experiment in local democracy" (Jayal, et al. 2006; preface).

5.4.3. OBSTACLES FACING THE *PANCHAYATI RAJ*

Prior to the constitutional amendments, the majority of the existing *panchayati raj* institutions were "moribund institutions; elections were held infrequently, local bodies

had limited autonomy, the *gram sabhas* were rarely convened, the local bureaucracy was generally resistant to ceding power to elected representatives and local elites tended to dominate decision making (deSouza 2000; as cited in Johnson 2003; p. 12). Even after the amendments, local government bodies remained varied, both in form and in function, largely because states reserved the right to determine the powers and activities of these bodies (Jayal, et al. 2006). In West Bengal, for instance, *panchayati raj* institutions became vehicles for the legitimisation and implementation of state policies. In Maharashtra, in turn, such structures developed into "an administrative outlet of the largesse of the welfare state" as opposed to fora for political deliberations. *Panchayati raj* institutions in Bihar became sites of conflict between the local poor and elites (Mitra 2001).

Some states gave *panchayati raj* institutions sufficient powers to act as effective 'self-government' and, in the process, to administer rural areas in a more responsive manner. In other states, functions were devolved readily enough, but *panchayati raj* were not given the requisite resources for carrying them out. Indeed, Jayal, et al (2006) detect a discrepancy between interpretations of 'democratic decentralisation'. For some, decentralisation is a means of improving the implementation of programmes; for others, it facilitates self-determination.

Other challenges have also confronted *panchayati raj* bodies. In practice, local government is funded through central government schemes; that is; their financial resources are often tied to centrally-planned programmes. This lack of fiscal autonomy limits the extent to which *panchayati raj* bodies are able to deliberate and determine their own economic development and social justice initiatives, as per their purview. Additionally, the various development programmes that are now interspersed across

the Indian development landscape frequently compete for institutional space with the *panchayati raj*. The Member of Parliament Local Area Development Scheme (MPLADS) exemplifies this. The programme grants members of parliament unrestricted funds to develop their constituencies without the need for such efforts to be aligned with formal *panchayati raj* priorities. There are no safeguards preventing an overlap between such programmes and the activities of *panchayati raj*. According to Jayal, et al. (2006), MPLADS allows for members of parliament to regain the patronage and clout that they may have lost following the 73rd and 74th constitutional amendments.

Indeed, these amendments did not specify the relationship between local government and other structures that operate at the local level, such as the District Collector. The lack of coordination between them is becoming an evident hindrance to the functioning of *panchayati raj* in a number of states. Even where local government has succeeded in seizing institutional space from central government initiatives, it still has to contend with the state government. Most states retain control over the finances of *panchayati raj* institutions through State Finance Committees and steer elections by defining constituency boundaries through State Finance Committees (Johnson 2003).

It is not only at the fiscal or administrative level that *panchayati raj* bodies find themselves in an uphill struggle. Various scholars have drawn attention to the quality of participation in local government, noting that "power – rooted in class, caste and gender – determines the informal functioning of local political institutions" (Johnson 2003, p. 2; see also Harris 2001; James, et al. 2001). Although the constitutional amendments established quotas for various marginalised groups (for instance, one-third of the seats in local government bodies are reserved for women) a number of constraints prevent these groups from participating fully in the activities of such

bodies. Jayal (2006) notes that "among the strategies used by upper-caste men to undermine women and lower-caste members are threats and intimidation; physical violence; taking advantage of the unlettered; and tokenism and surrogate representation" (p. 12). On a disconcerting note, Johnson argues that "[rural] decentralisation [is] part of a wider economic transformation in which affluent farmers have pushed for new channels through which to voice and institutionalise their interests" (p. 32; citing Bardhan 1998 and Jha 1999).

5.4.4. THE CHALLENGE FROM PARALLEL BODIES

The focus on decentralisation and liberalisation in India in the early 1990s not only reawakened the largely dormant notion of local government, but also spawned a range of other structures that act as arenas for public deliberations. These include "cooperative societies, the boards of private trusts, schools, colleges, temples, plus other institutions devoted to the furtherance of religion, social welfare, and the influence of organised interests such as caste associations, unions of farmers, workers and other voluntary organisation" (Manor 2001; p. 78)..

There has been a particular proliferation of non-governmental organisations, which deliver public services; user groups and committees, which manage natural resources; and self-help groups that deliver micro-credit and support small enterprise development (Jayal, et al. 2006). Many of these have been established and are supported by international donors (or, indeed, state governments) as alternatives to *panchayati raj* in implementing development schemes.

These 'parallel bodies' interact with *panchayati raj* in complex ways. The leadership of the two often overlaps. They may also cooperate in implementing development

projects by, for instance, selecting beneficiaries for government anti-poverty projects and in mobilising resources (Jayal, et al. 2006; Johnson 2003). However, these interactions are not necessarily supportive and parallel bodies and local government can also compete for legitimacy and funding. Parallel bodies may, for instance, influence *panchayati raj* elections by lobbying for or against certain nominations (Anathpur 2004). Their frequently overlapping jurisdictions create confusion and contest – in Uttar Pradesh, for instance, water users' groups and *panchayati raj* both formulate plans for irrigation management; construct, maintain and manage drains; and determine water prices (Jayal, et al. 2006).

Additionally, few parallel bodies have devised means of ensuring representativeness among their members. For instance, only a small number of such organisations hold elections. As such, parallel bodies represent an arena that can be co-opted by elites who have been excluded from *panchayati raj* as a result of electoral defeats or reservation policies. Jayal, et al. (2006) suggests that the plethora of parallel bodies that exist indicate reluctance among elected representatives from other levels to let go of power. As a result, parallel bodies may end up representing the interests of those with wealth and status, as opposed to the marginalised. That is not to say that *panchayati raj* necessarily offer a better alternative – elected local government representatives are often more accountable to bureaucrats as opposed to the electorate, and the extent of empowered participation has been questioned (*ibid*.).

Other scholars have, in turn, argued that it is too simplistic to represent parallel bodies as "either wholly benign or totally oppressive" (Anathpur 2004; p. 24). While some may indeed be "instruments of caste dominance" and "oppressive in nature, enforcing 'traditional' norms and hierarchies, notably in relation to caste and gender" (*ibid*.),

others are well-functioning and progressive (*ibid.*). Anathpur has documented parallel bodies in Karnataka, whose membership is varied and includes participants from different castes. She describes these parallel bodies as a 'congress' of sub-village caste organisations. Nevertheless, Anathpur acknowledges that it is possible that male members of upper, locally dominant caste groups dominate parallel bodies. The parallel bodies that she surveyed functioned through negotiation and compromise, as opposed to domineering practices. They are often led by 'a new leadership' based on political linkages, education, mobility and the ability to interact with government officials. Anathpur also notes that their activities were not limited to enforcing 'traditional' rules and norms; rather, they also provided social services.

The preceding section examined the evolution of *panchayati raj* in India and the challenges posed to them by parallel bodies. It sought to convince the reader of the complexity of the question of local governance in India's countryside. The following section casts the spotlight on local governance in the state of Andhra Pradesh, which is among the states that began developing biofuel under the National Mission on Biodiesel. Moreover, it has been the focus of a number of studies on local governance, and as such, provides a compelling site of analysis on the ability of the NMB to realise its 'pro-poor' objective through local governance structures.

5.5. Local governance institutions in Andhra Pradesh

Andhra Pradesh has been among the most reform-oriented states in India. The Telugu Dessam Party (TDP) and its leader Chandrababu Naidu presided over a period of transformations that began in 1995. The TDP was formed in the early 1980s as a state-specific party and has since its inception campaigned and governed on a populist

agenda (Mooij 2003). On assuming office in 1995, Naidu set about casting himself as an innovative leader by, among others, devising a programme of SMART – Simple, Moral, Accountable, Responsive and Transparent – governance. The programme was built around four themes: the separation of powers between administrative and elected officials; an emphasis on delivery and performance; the introduction of e-governance; and the enrolment of a broader range of stakeholders into processes of government (*ibid*). The cornerstone of the programme was local-level self-determination – whether through formal or informal bodies.

This scheme aimed to throw 'politics out of policy' (Mooij 2003) – to seep out corruption and to improve organisational integrity and transparency. Its goals reflected the 'good governance' agenda of international donors. As a result of its commitment to such reforms, Andhra Pradesh began to receive attention from the donor community, becoming the first state in India to secure a bilateral loan from the World Bank. This 'Andhra Pradesh Economic Restructuring Programme' injected funds into neglected social sectors and supported state government efficiency measures. Because the reforms became so high profile and closely linked with internationally funded development initiatives, the donor community now had a stake in ensuring their success.

Yet, despite the much-publicised governance reform agenda and its high-profile international backers, power remained centralised in the state capital, Hyderabad. Members of Parliament (MPs), Members of Local Assemblies (MLAs) and state-wide departments and administrative structures retained considerable control, and few functions were devolved to more local level institutions (Johnson 2003). Andhra Pradesh effectively "conformed to the basic requirements of the 73rd amendment,

but...failed to devolve substantial political, administrative and fiscal authority to [local government]" (*ibid*; p. 41). This is perhaps surprising, given that the state was a pioneer in establishing *panchayati raj* in the immediate post-independence period. These bodies held elections and had in place basic mechanisms of accountability and channels through which decisions were operationalised. In contrast to this past, some scholars argue the state has today taken steps that seem to deliberately undermine the authority of *panchayati raj* (for instance Mooij 2003; Johnson 2003).

Instead of promoting 'formal' *panchayati raj* institutions, the TDP government appeared to favour parallel bodies – including water user groups, joint forest management committees and various self-help groups – as the primary means through which 'self-determination' was exercised and poverty alleviation schemes were implemented (Manor 2000; Mathew 2001; Johnson 2003). The *Janmabhoomi*-programme and the irrigation reforms are frequently cited examples of the TDP's enthusiasm for parallel bodies. These programmes are reviewed in boxes 5 and 6 below. Several studies – including World Bank (2000b) and Manor (2000) – have argued that these programmes have come at the expense of *panchayati raj* institutions, which often have stronger mechanisms to ensure pluralism among their members and higher levels accountability.

Janmabhoomi – parallel bodies as political arenas

Established in 1997 by the Naidu-led TDP government, the Janmabhoomi ('land of one's birth') initiative was a rural development programme that sought to reduce poverty through community level efforts, such as watershed rehabilitation, joint forest management and credit provision (Mooij 2003). The initiative aimed to bring government to the people. The central pillars of the programme were voluntary labour contributions and grassroots level planning.

Janmabhoomi was implemented in 'rounds', each addressing a particular theme (for instance, water conservation, health or women). Initially, the programme ran four rounds per year, but these were later reduced to two. At the inception of each round, officials conducted Janmabhoomi meetings in villages during which stakeholders had the opportunity to express complaints or demands, and to identify priority activities. Stakeholders formed groups or committees related to the priority area of each round.

Although Janmabhoomi was a development programme in its own right, it intersected extensively with the main centrally-planned government development schemes. Funds from these schemes were distributed at Janmabhoomi meetings, and these meetings provided a forum for discussing pensions, village planning (such as gas connections and house sites), maintenance of rural roads and water supply, and local education.

According to Mooij, parallel bodies established under the auspices of the Janmabhoomi programme were characteristic of the TDP's mode of decentralisation. Indeed, an extensive World Bank report on decentralisation in India (World Bank 2000) concluded that the TDP had been reluctant to implement the 73rd amendment, which would have given formal *panchayati raj* more authority and autonomy. The state government instead directed its enthusiasm towards the Janmabhoomi programme and the parallel bodies that were established under its auspices. The World Bank study found, for instance, that the TDP government had marginalised and starved *panchayati raj* of funds. While the 73rd amendment sought to promote democratic decentralisation – that is, the delegation of policy and legislative authority from the central government to autonomous, local assemblies that have been elected by their constituents – the Janmabhoomi was an exercise in 'bureaucratic decentralisation'. The programme was controlled and implemented by local bureaucracies. Stakeholder groups and committees appointed by officials as opposed to elected by local communities.

Johnson (2003) argues that these features reflect the 'autocratic style' of Naidu as well as the TDP's strategy of exerting political control through the allocation of resources (see also Manor 2000; Mathew 2001). The TDP appears to have targeted its rhetoric towards poor groups, including so-called backward castes, women and agricultural labourers, with its populist message of redistribution.

Mooij concludes that "there is no doubt that the Janmabhoomi programme has been instrumental for the TDP in strengthening its base at the local level. The various committees are packed with TDP supporters and local TDP politicians are also the most important contractors for the works – because of their political influence, but also because they are often the only ones able to make a down-payment required in the name of community contribution" (p. 13).

FIGURE 6 JANMABHOOMI – PARALLEL BODIES AS POLITICAL ARENAS

Irrigation reforms in AP – participation or elite cooption?

Coinciding with the ascendance of the Telugu Dessam Party (TDP) and Chandrababu Naidu in Andhra Pradesh politics, the state embarked upon a range of reforms in its irrigation sector in the mid-1990s. These reforms sought to introduce a practice of participatory irrigation management (PIM), which would redistribute authority over irrigation issues from the government to farmers and other water users. The exceptional nature of these reforms cannot be overemphasised. Not only did they represent an extensive delegation of authority to a range of water users – an unprecedented step in the South Asian irrigation context – but they also commanded widespread political backing from the Hyderabad-based state government (Mooij 2003).

It is difficult to pinpoint a single trigger for these reforms. On the one hand, the international donor community had recently begun to promote stakeholder participation in development projects as best practice. Moreover, Indian states had been granted greater autonomy over their affairs, and Andhra Pradesh was in negotiations with the World Bank for the first-ever bilateral loan between an Indian state and the Bank. On the other hand, Andhra Pradesh had at its helm a new leader, who sought to project an innovative and reform-minded image of himself and his government. The introduction of PIM would coincide with this agenda.

The irrigation reforms, which subsequently became enshrined in law, redistributed authority to institutions at three levels. At the level of the entire irrigation project (the primary or system level), the reforms called for the creation of project committees. Distributary committees were set up at the distributary (or secondary) level, and water user associations (WUAs) were established at the canal (or tertiary or minor) levels. Elections were held to select members to the managerial posts of these committees and associations. Clusters of approximately ten WUAs constitute a distributary committee. Both WUAs and distributary committees manage their own finances, and mainly organise the rehabilitation or maintenance of irrigation infrastructure. They also have the authority to reorganise water distribution.

How successful were these committees and associations in facilitating participation in irrigation management? Most assessments report a mixed success. It is not uncommon for the leadership of the WUAs to come from higher casts and/ or large landowners. A number of them own business, and have taken out contracting work in their own jurisdiction. Moreover, political parties are known to influence committee membership. Ten thousand WUAs were formed in 1997, many of which provided channels through which Naidu's TDP could expand its influence. Moreover, low levels of interaction between the leadership and membership were reported in a number of countries.

Overall, the reforms sought to shift power from the state's irrigation department to water users, and in the process, to facilitate the inclusion of water users' perspectives into irrigation management. However, there seems to be little evidence of participatory technology development in the rehabilitation and maintenance works that have taken place. The leadership of committees and associations – the rural elites – reinforce existing strong linkages to the irrigation department. Why have the reforms failed to promote greater participation? There appears to have been little awareness of the irrigation reforms among water users. The first WUA and distributary committee elections were organised on short-notice, and did not attract a large voter turnout. Moreover, WUAs, distributary committees and project committees are said to face the same difficulties as other local representative bodies – they are platforms for the launch of political careers; fora through which to accumulate social and political capital and to redistribute resources to supporters. There appears to be little ownership of the new institutions by those stakeholders, who stand to gain the most.

FIGURE 7 IRRIGATION REFORMS IN ANDHRA PRADESH – MORE PARTICIPATION?

Mooij argues that programmes such as *Janmabhoomi* and Participatory Irrigation Management (PIM) can be at least partially explained by the political culture that existed in the state under Naidu's government. While the TDP government appeared to have been successful in carving out an image of itself as a forward-looking regime, keen to embrace new technologies as a means of driving economic growth, these programmes showed that it was also committed to agricultural and rural development. Mooij also asserts that these programmes were means through which Naidu's TDP government expanded and sustained its base among the large rural electorate in Andhra Pradesh. Given that these initiatives had been established by the TDP government, the parallel bodies that were set up under their auspices were likely to be populated by individuals sympathetic to the TDP cause. The same could not be guaranteed of *panchayati raj*.

Mooij also argues that programmes such as *Janmabhoomi* allowed Naidu to depoliticise development by creating a 'cover' under which his regime was able to carry out other policy reforms – notably those pertaining to economic liberalisation – which may have proved unpopular: "By focusing mainly on local issues, many of which are related to governance in a rather technical sense, [Naidu] would have succeeded in insulating the [economic] reform process from democratic procedures and people's participation [in non-economic issues]" (p. 21).

Mooij suggests that in Andhra Pradesh – as in many other developing contexts – policy visions or papers are rarely contested. Rather, they are challenged during implementation. Policy implementation "is contested, sabotaged, manipulated or corrupted in many different ways" (*ibid*.). The lack of debate during policy formulation

implies that 'advocacy coalitions' (Jenkins-Smith and Sabatier 1993) are largely absent in Andhra Pradesh. While policy 'visions' may be projected by community consisting of the chief minister, officials of the bureaucracy, party members, businessmen and representatives of the media, policies themselves are determined by the agendas of ruling political parties (Mooij 2003).

5.6. The implications for the National Mission on Biodiesel in Andhra Pradesh

5.6.1. Effectiveness of *panchayati raj* and parallel bodies

What are the implications of these insights for the National Mission on Biodiesel in Andhra Pradesh? The state proposed using non-forest and other lands in four districts – Adilabad, Karimnagar, Medak and Nalgonda – for *Jatropha* plantations. It was to seek the assistance of parallel bodies and *panchayati raj* institutions in realising its 'pro-poor' goals in villages in these districts.

Involving *panchayati raj* and parallel bodies into the initiative appears at first glance to be an unproblematic way of enrolling intended beneficiaries into the scheme and fostering a sense of ownership. The preceding sections suggest, however, that these institutions and their established cultures may in fact serve to entrench existing inequalities by continuing to frame contentious, political issues as 'technical' and thereby external to the realm of the 'non-expert' public.

Panchayati raj and parallel bodies embody the tenets of decentralisation, governance and participation (outlined in section 5.2). However, past experience has provided mixed signals regarding the effectiveness of such institutions to empower stakeholders and solicit their inputs into decision-making processes. In India, complex fault lines along class, caste, gender and other identities empower some stakeholders over others.

Indeed, these institutions face challenges in ensuring equitable participation by all stakeholders.

The very existence of analogous institutions – *panchayati raj* and parallel bodies – appears itself to be a hindrance for the effective functioning of either. The two compete for legitimacy and resources. Indeed, decentralisation has been argued to be a meaningful political strategy, whereby national or state-level elites can access new arenas of influence. This certainly appears to have been the case with both *Janmabhoomi* and PIM in Andhra Pradesh. The parallel bodies established under *Janmabhoomi*, for instance, essentially became political arms of the ruling TDP party.

Moreover, and reflecting the liberal democratic tradition that they stem from, these institutions are expected to solicit 'formal' and 'external' expertise and technical skills to facilitate deliberations (Jayal, et al. 2006). The National Mission on Biodiesel in Andhra Pradesh reflected this – the implementing bodies were envisioned to obtain technical backstopping from experts. However, this would appear to encourage stakeholders to choose from off-the-shelf options that have been pre-defined by experts. As such, they indicate some of the constraints that participatory mechanisms and institutions face: they are limited in their ability to facilitate earlier engagement with policy processes.

It is not only at the agenda-setting stage that stakeholder participation may be restricted. Such processes may also face constraints in feeding back experiences from the field in order to readjust policies. In the case of the National Mission on Biodiesel, 'expert claims' regarding the performance of *Jatropha* and the status of wastelands were challenged on the basis of 'on the ground' experience by farmers, non-

governmental organisations and other actors. One interviewee – a director of an NGO working throughout India on renewable energies – conveyed anecdotal evidence from farmers who had begun *Jatropha* cultivation, questioning whether the crop actually performed as well as test plot results implied. According to the farmers' experiences, the crop required regular and high levels of irrigation, along with other inputs, such as fertilisers, in order to produce the expected yields. Another interviewee – a representative of a non-governmental organisation specialising in rural development and operating in Andhra Pradesh – noted that wastelands were in fact widely used by poor, marginalised communities as grazing lands for livestock. Far from being unproductive, these lands were integral to the livelihoods of these communities.

However, given the dynamics that have been shown to operate in *panchayati raj* and parallel bodies, there are reasons to be doubtful as to whether such alternatives to dominant narratives find space for expression in these arenas. Although their *raison d'être* conventionally entails facilitating the 'participation' of the intended beneficiaries in the design of development schemes – and in the process, fostering a sense of 'empowerment' and 'ownership' – they appeared to have been consigned a more narrow task of implementing a pre-defined plan in the case of the National Mission on Biodiesel. These institutions were charged with tasks such as setting up and overseeing plantations and coordinating the collection of seed (Planning Commission 2003). How might this be explained?

5.6.2. Centralised vs. decentralised rule

In seeking an answer, we return to the seemingly paradoxical nature of Indian political culture that was introduced in chapter 2. On the one hand, Indian politics have been defined by a strong tradition of central government-led development; on the other,

they have also been infused with elements of local-level self-determination since the pre-independence period.

The paradigm of centrally-led development is based on an agenda, drawn up by nationalist leaders such as Nehru and Ambedkar, who sought to suppress sectarian divisions during the struggle for independence by proposing a unifying endeavour to modernise India. The Planning Commission came to embody these ideal. For the Planning Commission, 'planned development' was an issue of scientific, rational problem-solving, and scientists, economists and industrialists held the necessary expertise to design it. According to this vision, development would be powered by large-scale industrialisation – a vision that was distinct from Gandhi's ideal of village-level self-sufficiency and self-rule (Dasgupta 2001). Indeed, this dichotomy between centrally-planned schemes and decentralisation has sustained itself, and is demonstrated in the National Mission on Biodiesel.

The Planning Commission assumed its present form in 1950 and it has in the intervening decades expanded into a vast administrative body, whose "potential dominating effect...may not be hard to guess" (Dasgupta 2001; p. 67). Dasgupta (citing Dandekar 1994) notes that even during the early 1990s, when liberalisation was beginning to take hold, the Planning Commission controlled nearly a third of the total expenditure of the government. Despite the increasing autonomy of individual states under India's federal system, "the historically crucial role of [the Planning Commission] during the last five decades, both at the central and also indirectly at the state levels suggests a continuity of central dominance" (Dasgupta 2001; p. 67). Indeed, state governments have sought to cooperate with the Planning Commission and other

national organisations on policy initiatives, since centrally-led schemes have allowed states to tap into often much needed financial resources (*ibid*.).

The National Mission on Biodiesel document is a product of the Planning Commission paradigm. It set out a meticulous plan for the realisation of the Mission, and earmarked funding for its implementation. Although chapter 4 highlighted the enrolment of actors beyond the state in policy deliberations around the Mission, it was the Planning Commission that published the final document in a manner that mirrored its customs (Planning Commission 2003). Experts are seen to have established 'facts' about the socio-economic benefits of biofuel, the performance of *Jatropha* in specific agro-ecological conditions and the utility (or, lack thereof) of wastelands. Once established in the sphere of science, these disinterested facts are received into the realm of policy and policy actors make decisions on their basis.

Thus, participation during the policy process around the National Mission on Biodiesel appears to have been encouraged; albeit within carefully defined boundaries. This form of participation appears to conform to the interpretation of participation put forward by Cooke and Kothari (2001). This 'new tyranny' fails to interrogate motivations and behaviour of running participatory processes. Through rhetoric and tools, participation often conceals a commitment to managerialist effectiveness. Moreover, it may also act as a diversionary tactic by emphasising micro-level interventions and leaving intact broader inequalities and injustice (*ibid*.).

5.7. CONCLUSIONS

Assessments of India's recent experiments with decentralisation often represent the two extremes of a spectrum (reviewed in Johnson 2003). On the one hand, scholars writing from a liberal democratic perspective maintain that decentralisation has succeeded. The challenges that remain are thought to be the result of failure in implementation. On the other, critical accounts suggest that the devolution of power has been mere 'window-dressing'. Instead of truly transforming practice, they serve to reproduce existing social disparities based on caste, religion, class and gender or to create new ones. Indeed, these aspects highlight "the difficulty of transposing a formal model of democracy onto societies in which power and politics are still determined by highly informal systems of inequality and domination" (Johnson 2003; p. 30).

Control over technological choices has traditionally rested on the shoulders of a narrow community of elites. However, as such choices have been increasingly recast as political in nature, a clear gap has become apparent between those affected by technological decisions and their ability to take part in making them (Mohan and Yanacopulos 2007). 'Public participation' through local governance institutions, such as the *panchayati raj* and parallel bodies, is thought to be one means of redressing the imbalance. However, as this chapter has sought to demonstrate, the ability of such institutions to facilitate equitable and empowered participation is problematic.

In India, the analogous systems of *panchayati raj* and parallel bodies serve to undermine the effectiveness and authority of either. The planned implementation of the National Mission on Biodiesel through these systems illuminates their shortcomings – in particular, the centrality of experts and other elites and the narrow space for 'non-expert' voices, which the room for alternative perspectives to emerge. By extension, they reinforce a tradition of technocratic development and as a result

compromise the potential for change of scheme such as the National Mission on Biodiesel.

CHAPTER 6: CONCLUSIONS

6.1. TRANSLATING RHETORIC INTO CONCRETE ACTION

This thesis has explored the reciprocal relationship between technology and society through a case study of the Indian National Mission on Biodiesel. Although it is tempting to view technology as an force guided by an inner logic that acts upon society in an instrumental manner, the thesis has shown how technology can lend itself to contesting socio-technical narratives; how these narratives are stabilised into 'truths' in policy processes; and how technology can be expected to change society, albeit in unexpected ways.

At the outset of this research, biofuels were receiving largely positive commentary. Their potential for agricultural and rural development, climate change mitigation and environmental sustainability, as well as energy security and macro-economic growth were heralded worldwide. Since then, however, there has been a gradual proliferation of voices expressing the potential negative consequences of biofuel development. What began as critical stances on the climate friendliness of biofuels, moved to claims that biofuels as one of the main culprits of food price increases and food shortages and that their production denied poor people's access to land (Cotula, et al. 2008).

It is at this apparent turning point that the thesis has sought to unearth the postulations underlying the National Mission on Biodiesel; the processes through which they have become enshrined in this initiative; and the institutional milieu that is meant to act as the conduit for the rural development benefits of biodiesel. In the tradition of past studies of science, policy and development (Keeley and Scoones 2003; Scoones 2006), the discussion has explored how technologies and policies are created

through the interaction of multiple actors and whether alternative discourses and incremental changes might emerge. Overall, the dissertation has sought to provide a critical commentary on the instrumentality of technology-led development

Chapter 3 attempted to untangle the global and local manifestations of biofuels. It identified the socio-technical narratives embodied in 'global' biofuel policy discourse, as well as their 'local' counterparts in India. The chapter argued that biofuel policy discourse embedded paradigms of 'technological determinism' and 'development as modernisation'. These define societal challenges in technicist terms, making technological interventions virtually inevitable.

Indeed, technocratic discourse often serves to "impose systematic frames of meaning on events that might otherwise seem random" (Jasanoff 2004; p. 280). In the case of biofuel, such discourse has attempted to stabilise contentious claims across a range of spheres, including agriculture, rural development, economic growth, environment, energy, climate change and international trade. Biofuel has been cast as a unifying project that can unproblematically span these spheres. Yet, sustained debates between food and fuel; economic growth and energy security; and the environmental impacts of biofuel suggest that the endeavour has been far from successful.

Upon closer examination, the narratives underlying biofuel reveal themselves to be contested. In the case of the National Mission on Biodiesel, points of debate included the status of 'wastelands', the ability of *Jatropha* to perform according to expectations and the institutional arrangements between the public and private sectors that would allow the Mission to achieve its objectives. The thesis has argued that these conflicting standpoints problematise the conventional perception of technology and its

relationship to society, revealing instead its socially constructed nature. What becomes understood as 'technological certainty' – and 'policy truth' – is in fact the product of consensus-making.

Chapter 4 turned to the processes through which the consensus around the National Mission on Biodiesel was reached. The National Mission on Biodiesel builds on a long-standing culture of technocratic policy processes in India. Since its independence, India has openly pursued a goal of modernisation, with science and technology acting as the cornerstones of this effort. Until recently, science and technology were mobilised through vast, centrally planned and financed efforts. The technocratic constituency was relatively narrow, consisting mainly of politicians, bureaucrats and scientists. It is paradoxical that this elite community was able to sustain its position in a political system that is described as the world's largest democracy. India's overall style of politics – radical in tone, while conservative in practice; building on group identities and interests, despite attempts at undermining these through equality measures – provides some explanation as to how and why initiatives framed, planned and implemented by elites secure popular support.

However, important changes are beginning to take place in the context of Indian policy-making. New technologies and the 'New Economy' are ushering in a new culture of technocracy. Science and technology have not lost their standing as motors for societal change; but, the community of actors that shapes science, technology and policy appears to have widened. No longer is it sufficient to accredit individual 'science czars' with the launch of science and technology initiatives. The contemporary context would suggest that it is more likely to be the work of diffuse networks that bring together (even if transiently) wide-ranging policy contributors.

In the case of biodiesel, this community ostensibly included civil society and private sector organisations, in addition to politicians, bureaucrats and scientists. As the study of the National Mission on Biodiesel suggests, however, reconciling the frequently disparate agendas of various actors is not without its problems. Interviewees noted that the private sector had been particularly apt at incorporating its interests into the nascent initiative. They expressed concern as to how the emergent biodiesel sector in India – now starting to be dominated by private industry – would succeed in delivering the promised rural development benefits

Indeed, the thesis unravelled two agendas that crystallise the ambitions of the National Mission on Biodiesel – one based on a 'pro-growth' scenario and another on a 'pro-poor' outcome. The 'pro-poor' ambitions of the National Mission on Biodiesel were to be realised through a complex terrain of rural governance institutions – mainly, *panchayati raj* and parallel bodies. As outlined in chapter 5, the rationale for the establishment of these institutions was to undermine entrenched inequalities by promoting pluralism in membership and participation in policy discussions. However, the thesis found that the effectiveness of both sets of institutions has been compromised. The two are frequently found to compete for institutional legitimacy and resources. Moreover, these institutions are vulnerable to being co-opted by technical experts and other elites. This undermines the extent to which the voices of all stakeholders – and particularly those, who are marginalised – can be heard. The result is a reinforcement of the prevalent technocratic culture of economic growth and social development.

Ultimately, the analysis has shown that "while bureaucracies may easily coalesce around a problem and make big noise, translating rhetoric into concrete action is much harder" (Keeley and Scoones 2003; p. 18).

6.2. THE NATIONAL MISSION ON BIODIESEL – A SERIES OF TENSIONS

Overall, the thesis identifies a series of tensions at the core of the National Mission on Biodiesel, which it argues, weakens its potential particularly as a rural development scheme. Firstly, the underlying premises upon which the Mission was articulated were contested. Was *Jatropha* a 'miracle crop' that could thrive on marginal soils with limited input? Or did it, in fact, require inputs such as regular irrigation and fertilisers to produce the necessary yields?

Secondly, the status of 'wastelands' was equally ambiguous. On the one hand, it was claimed that these were unused; on the other, they were claimed to be economically and ecologically productive, particularly for marginalised communities. Thirdly, an examination of the policy processes around the National Mission on Biodiesel revealed a conflict between technocratic and participatory practices. A similar strain appeared between a tradition of centralised decision-making, and more recent decentralisation processes that sought to devolve decision-making authority to local levels.

These tensions appeared to culminate in the discord between the 'pro-growth' and 'pro-poor' agendas of the National Mission on Biodiesel. The former was concerned with maximising productivity and returns on investment, while the latter sought to generate employment opportunities and additional income sources, secure rural energy supply, and improve the livelihoods of marginalised communities. The National

Mission on Biodiesel aimed to reconcile the two, potentially mutually-exclusive scenarios. They implied distinct networks of actors, whose interests had to be reconciled for biofuel – as a single policy tool – to realise multiple policy goals. In hindsight, the decision to cancel the National Mission on Biodiesel may at least partially be accounted for by the failure to fill the fissures that existed at the core of the initiative.

6.3. POST-SCRIPT: THE CURRENT STATUS OF THE SCHEME

This research is based on data collected during two separate field visits to India – in January-February 2007 and July-November 2007 – as well as through documentary analysis in the interim. As a nascent scheme, the National Mission on Biodiesel evolved during the period of research. In the event, the latest reports from India suggest that the initiative has been given "a quiet burial" (The Economic Times of India; 4.8.2008). Prompted by recent rises in the global price of food, newspapers reported that the policy actors behind the scheme had become weary of businesses amassing land for the development of biofuel at a time when food was becoming increasingly costly. According to one media report:

> *"'The [group of ministers] has recommended that the national mission on biodiesel of the ministry of rural development need not be pursued further', an official source close to the development said. The [group of ministers], chaired by agriculture minister Sharad Pawar, even rejected a modified proposal of the department of land resources (in the ministry of rural development) to launch the mission with reduced area and cost (for biofuel plantation). The national mission on biodiesel had envisaged to have almost 4 million hectares under biodiesel crops such as Jathropa and Sweet Sorghum involving a total investment of Rs 1,400 crore [14 000 000 000 rupees]. Sources said the mission was left mid-way as there was apprehension over the large acquisition of land by big energy majors. Companies across public and private sector have already rolled out plantations in about 3 lakh [300 000] hectares of wasteland spread across the country. Insiders say the policy makers developed a cold feet fearing*

> *land-grabbing by corporates in the garb of biofuel plantation"* (Times of India; 4.8.2008).

Indeed, interviewees expressed doubts as to the ability of the National Mission on Biodiesel to deliver its 'pro-poor' goals in a policy environment that appeared to favour private sector investments into the emergent biodiesel sub-sector. Elements of the National Mission on Biodiesel have instead become incorporated into a new, overall biofuel policy (Government of India website). This National Biofuels Policy has high-level backing – it is being coordinated by a committee that is chaired by the Prime Minister, Manmohan Singh (*ibid*.). Under this initiative, India commits itself to achieving 20% blends of bioethanol and biodiesel by 2017. The policy abolishes taxes and duties on biodiesel in efforts to encourage further biodiesel development activities. It has been approved by a ministerial group overseeing energy policy, and according to some media reports, is awaiting approval by cabinet (Biofuel Digest; 25.7.2008).

As with the National Mission on Biodiesel, the policy has immediately come under scrutiny, with suggestions that it fails to address the competing renewable energy agendas of the energy and agricultural ministries (*ibid*.), as interviewees had suggested previously. Despite touting itself as the next 'clean energy hot-spot', some interviewees suggested already at the time of data collection that India's overall efforts in renewable energy – including biofuel – may be compromised due to a high-profile deal on nuclear energy that was being negotiated between India and the United States (for instance, Parthasarathy 2007) and that has since been approved (The Hindu; 3.10.2008).

6.4. EMPIRICAL AND THEORETICAL CONTRIBUTIONS

The thesis set out to make two contributions: firstly, to add a qualitative account to the emerging – and largely quantitative – knowledge base around biofuel; and secondly, to

contribute towards the convergence of Science and Technology Studies and Development Studies.

In terms of the former, the thesis has sought to problematise the postulations that underlie the concept of biofuel in more quantitative accounts. It aimed to expose (as opposed to impose) frames of meaning of biofuel in India and to understand how these meanings had given rise to the patterns of policy-making around the National Mission on Biodiesel.

In terms of the latter, the thesis aimed to demonstrate the compatibility and value of integrating concepts from Science and Technology Studies and Development. As such, it contributes to the growing stream of research, which explores why certain truths are tenaciously present in policy deliberations, how these are reinforced and whether, and if so how, they are challenged (Keeley and Scoones 2003; Scoones 2006). The thesis represents a 'trial run' of such ideas within a novel empirical context.

More specifically, the findings of the thesis confirm previous research that questions the 'naturalness' or 'inevitability' of policies (for a classic paper, see Lindblom 1959). In contrast to the traditional notion that policy-relevant knowledge is 'received' by decision-makers in the political sphere from experts in the scientific sphere, the thesis corroborates the results of prior analyses, which have documented the blurring of science-policy boundaries that takes place during policy processes (Van der Sluijs, et al. 1998). Moreover, by tracing the obscurement of these boundaries during the deliberations leading up to the National Mission on Biodiesel, the thesis confirms a central tenet of contemporary Science and Technology Studies – that science is *socially-shaped* (MacKenzie and Wajcman 1999).

Finally, the investigation of the institutional milieu through which the National Mission on Biodiesel intended to deliver its development benefits implied that while indeed the scheme could be expected to impact society, it would do so in unexpected ways (*ibid*.; Akrich 1992). The performance of the proposed channels of implementation have been shown to be uneven at best – at discriminatory at worst (Mooij 2003). A continued reliance on such institutions for policy design and implementation implies a reinforcement of technocratic development. Although prevalent, this paradigm has been shown to deliver limited advantages to marginalised communities in India (*ibid*.). Although 'the New Economy' era may have brought with it a promise of more open and inclusive policy processes, the staying power of a technocratic mindset within India's policy spheres suggests that this promise has gone largely unrealised. As such, the transformative potential of the National Mission on Biodiesel could be expected to be limited.

6.5. BROADER IMPLICATIONS

As the previous chapters have demonstrated, a number of countries have formed policies mandating the replacement of fossil fuels with their biological equivalents. Implicit in these policies is the assumption that the socio-technical claims around biofuels are uncontested. Indeed, biofuel might be viewed as a set of 'hot' and 'cold' topics. MacKenzie (2007; informed by Callon 1998) maintains that "in 'cold' situations...actors are identified, interests are stabilized, preferences can be expressed [and] responsibilities are acknowledged. The possible world states are already known or easy to identify. Protagonists already know how to calculate their costs and benefits and are ready to negotiate" (MacKenzie 2008). Conversely, "in 'hot' situations, everything becomes controversial:...The list of actors ['non-human' & human] will

fluctuate. Nothing is certain, neither the knowledge base nor the methods of measurement" (*ibid*.).

This dissertation has sought to make the case that biofuels in general, and the National Mission on Biodiesel in particular, are 'hot topics'. Policy actors may have attempted to 'cool' it in order to formulate the scheme. However, as the preceding discussion has shown, these efforts did not quell controversy and debate. Interviewees flagged the issue of extensive private sector involvement in a scheme that had also been motivated by rural development concerns. In the event, the Indian government appears to have awakened to the potential drawbacks of such a scenario, particularly in light of the increasing costs of food.

The case illustrates the challenges that may lie ahead when vast initiatives, such as the National Mission on Biodiesel, are formulated on the basis of uncertainty and controversy. In the absence of consensus and ownership among implicated actors, such schemes risk failing to realise their potential for change. Recent sociological analysis of biofuel has characterised the biofuel arena in terms of national- and local-level biofuel networks, which are becoming integrated to emergent global biofuel networks (Mol 2007). According to Mol (2007), the rapid proliferation and globalisation of biofuels have sparked debates regarding the environmental sustainability of biofuels and the social vulnerability of two groups in particular: the poor and small farmers. Mol recounts the position of economic and political elites that "if biofuels are to make a significant contribution to climate change mitigation, energy security and rural development, then biofuel production and consumption needs to globalise further, to become part of the global space of (energy) flows. This might, however, further endanger specific localities, interests and sustainabilities: most notably, the interests of

small farmers and the poor in developing countries and specific local environmental sustainabilities (rather than global climate change)" (p. 300). The findings of this thesis are in support of such views.

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APPENDIX 1: INTERVIEW GUIDE

Background information

1. It seems that 'latent interest' in biofuel has existed in India for decades. When did initial interest in biofuel emerge? What were some of the factors behind it?
2. It appears that biofuel is the form of bioenergy that is receiving the most attention at the moment. How would you characterise the bioenergy field in India, and the positioning of biofuel within it?
3. Where has this renewed interest in biofuel come from? Have some factors been more important than others in raising its profile?
4. How would you describe the current biofuel environment in India?
5. What types of activities are taking place within it?
6. Which actors are shaping the environment at the national level?
7. It appears that the National Mission on Biodiesel is among the most prominent initiatives that are currently taking place in India. How would you describe the positioning of the Mission in the overall biofuel environment?
8. The first phase of the NMB has just run out –to what extent would you say that it achieved its objective [demonstrating the feasibility and benefits of a biofuel sector]?
9. What is the feasibility of the second phase [establishment of a self-sufficient biofuel sector in India] realising its objectives?

Biofuel discourse and narratives

10. What are the different visions and expectations around biofuel?
11. Could you identify some of the assumptions that they build on?

12. Are they specific to particular organizations or sectors?
13. What institutional arrangements are implied by them?
14. Who are the intended beneficiaries?
15. How does adherence to a particular vision reflect the interests of the stakeholders?
16. How do they reflect global efforts in biofuel?

Policy processes

17. How would you describe the policy deliberations around the National Mission on Biodiesel?
18. Are you aware of the timeline of developments?
19. Are you aware of which actors were involved?
20. How would you describe their roles in the formulation of the National Mission on Biodiesel?
21. Could you reflect on their interest in biofuel development?
22. I am trying to get a sense of the types of consultations that took place. What was your experience of them? [OR] What was your perception of them? [Prompt: technocratic vs. participatory]

'Biodiesel for rural development'

23. The National Mission on Biodiesel has stated as one of its aims the revitalisation of rural areas. What do you understand by this?
24. How does this aim relate to the others stated in the Mission [energy security; environmental protection; energy security; economic growth]? [Prompt: compatible vs. contradictory].

25. The National Mission on Biodiesel has identified *panchayati raj* and parallel bodies are some of the organisations involved in realising its rural development objective. Why do you think that these institutions have been recruited to the task?
26. How would you characterise these institutions? What are their aims?
27. How would you describe the relationships between them?
28. How effective would you say that such institutions have been in realising their aims?
29. What does this imply in terms of their ability to deliver the biodiesel scheme's rural development ambitions to the intended beneficiaries?
30. Could you illustrate your statements with reference to specific states?

APPENDIX 2: LIST OF INTERVIEWEES

LIST OF INTERVIEWEES

1. Amit Walia – Integrated Research and Action for Development (IRADe)
2. Arvind Reddy – Winrock International India
3. Bellum Reddy – International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
4. Bhavana Rao – Centre for People's Forestry
5. Gangadhar Vagmare – Centre for Sustainable Agriculture
6. Bhojvaid – The Energy and Resources Institute (TERI)
7. Jack Steege – Independent consultant
8. N. Satish Kumar – Southern On-line Biotechnologies
9. Neeraj Sinha – Vigyan Bhavan (Inter-State Council Secretariat)
10. Jadhav & Kumar – Nanadan Biomatrix
11. Prasad & Kumar – Naturol
12. D.Raghunandan – Centre for Technology and Development (CTD)
13. V.P. Singh – World Agroforestry Centre (ICRAF)